EXHIBIT C

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(54) **ELECTRICAL DISTRIBUTION WIRING MODULE**

(76) Inventor: **Michael P. Gorman**, Laguna Niguel, CA (US)

Correspondence Address:
LAW OFFICE OF GLENN R. SMITH
28626 BROOKHILL ROAD
TRABUCO CANYON, CA 92679-1163 (US)

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Related U.S. Application Data

(62) Division of application No. 10/443,444, filed on May 22, 2003, now Pat. No. 6,884,111.

(60) Provisional application No. 60/383,269, filed on May 23, 2002. Provisional application No. 60/441,852, filed on Jan. 21, 2003. Provisional application No. 60/631,244, filed on Nov. 26, 2004.

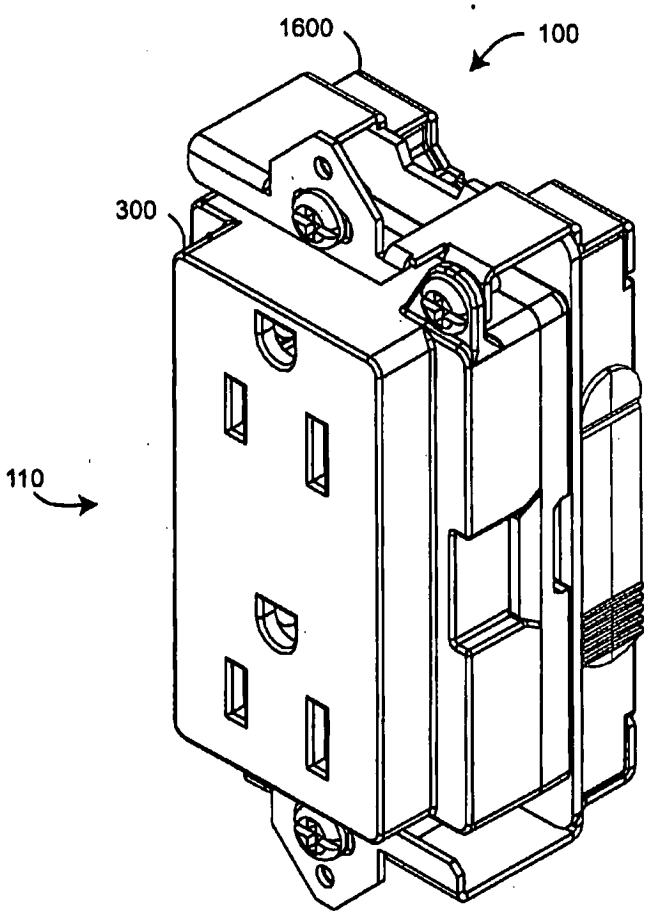
Publication Classification

(51) **Int. Cl.**[7] **H01R 13/60**

(52) **U.S. Cl.** **439/535**

(57) **ABSTRACT**

A wiring module adapted to mount within an electrical box has a functional side and an opposite wiring side. The functional side has sockets adapted to removably connect with a functional module. A terminal set provides a conductive portion of the sockets and is adapted to terminate a power cable. A shield is disposed proximate the wiring side so as to seal the terminal set.



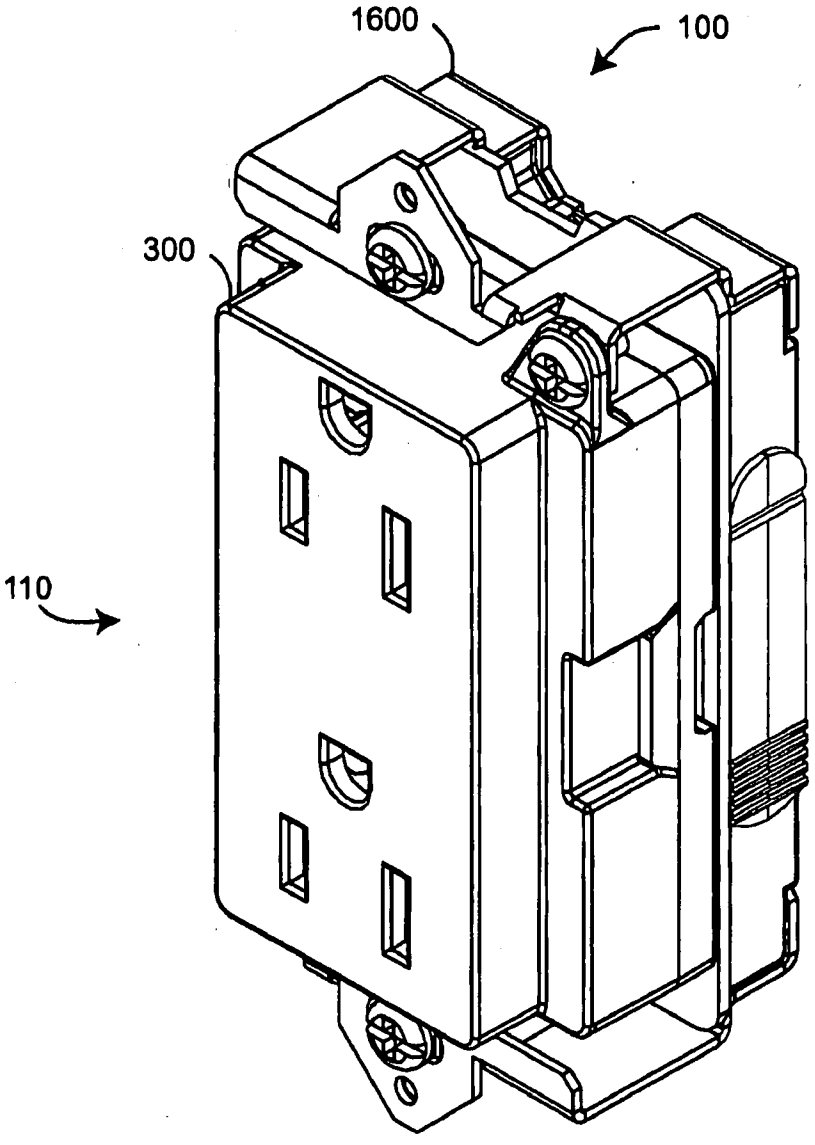


FIG. 1A

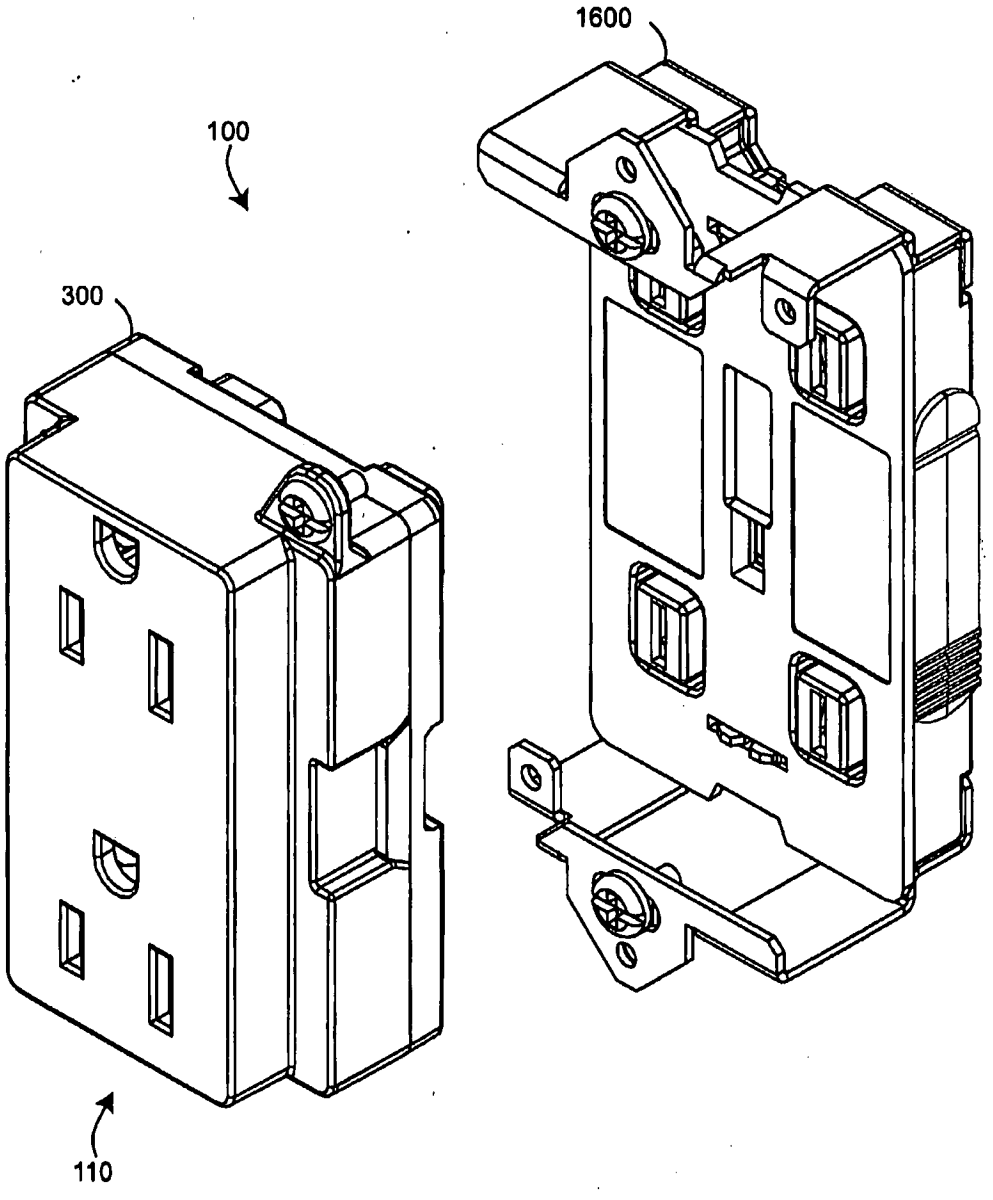


FIG. 1B

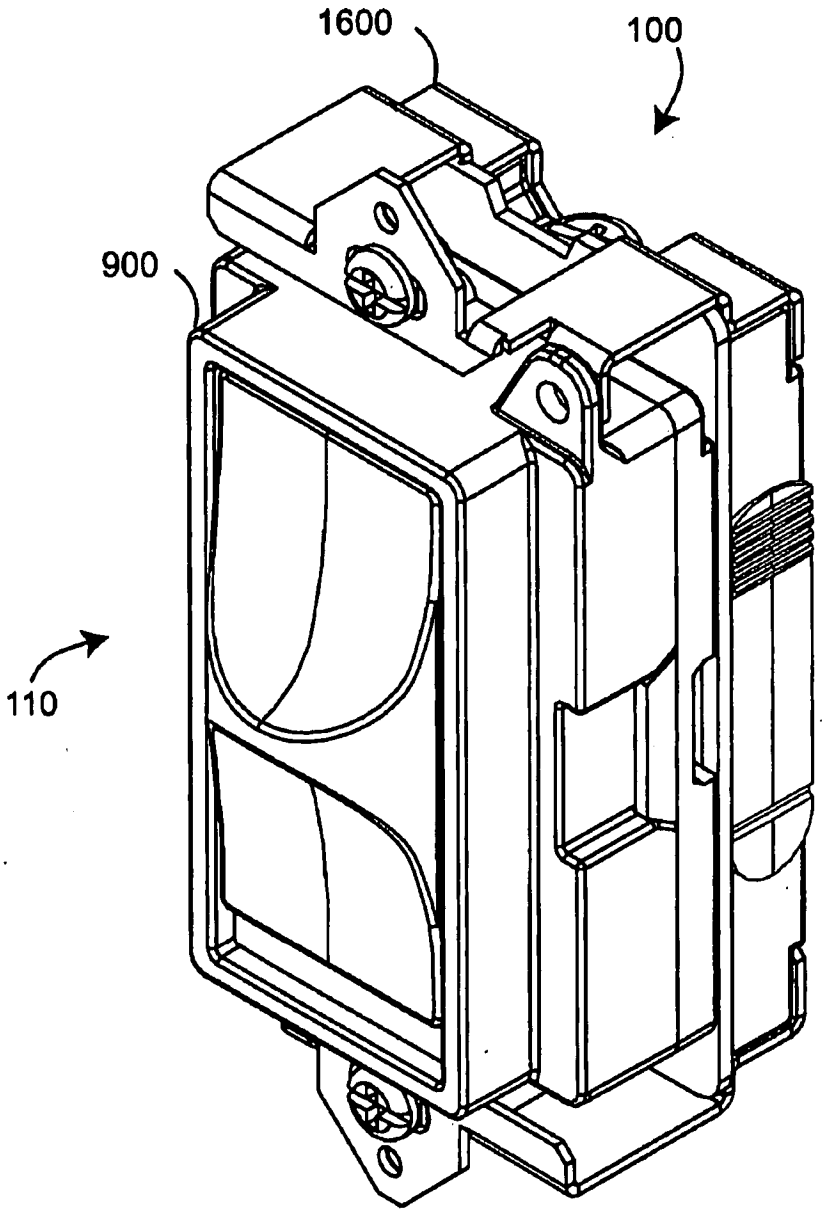


FIG. 2A

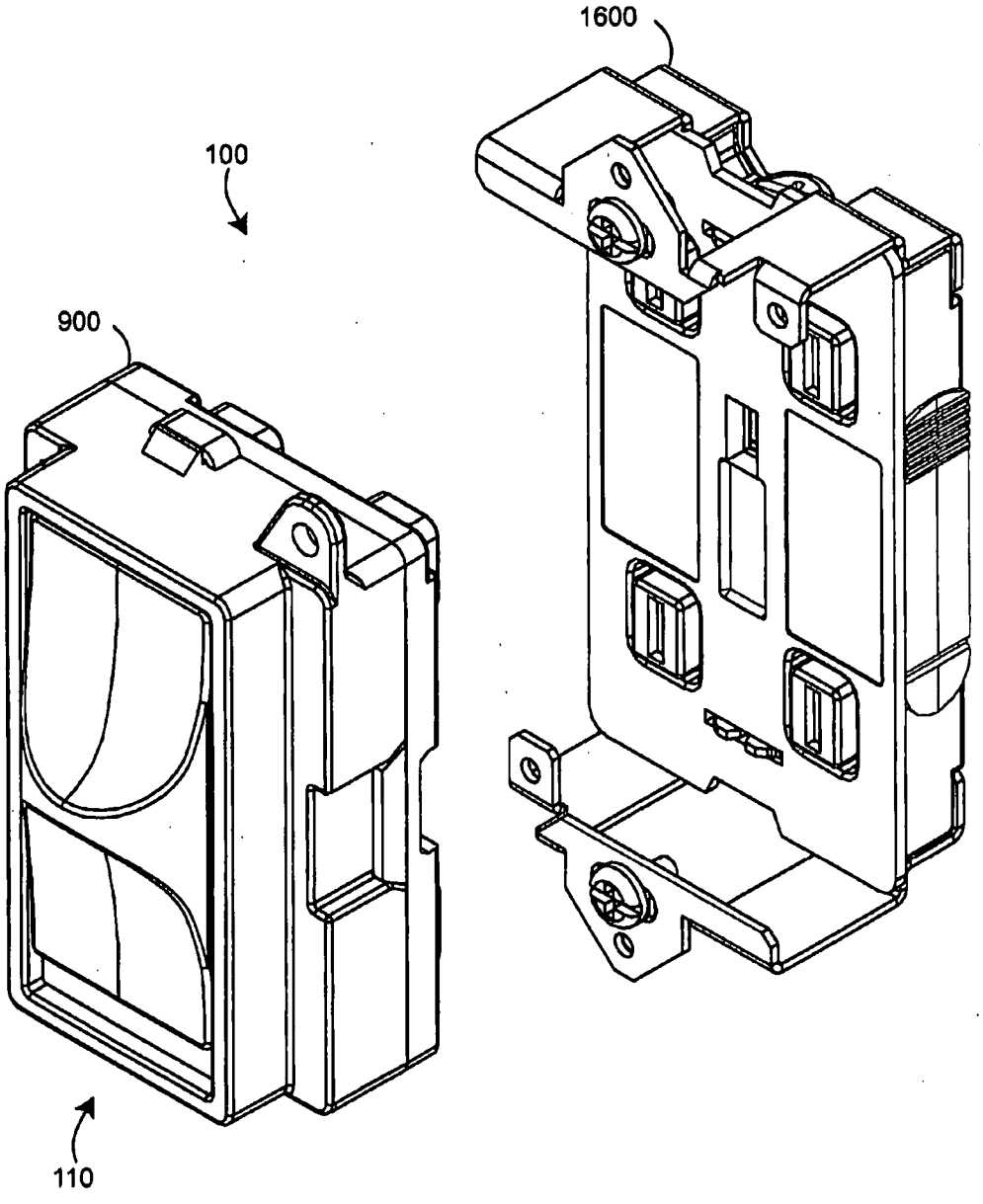


FIG. 2B

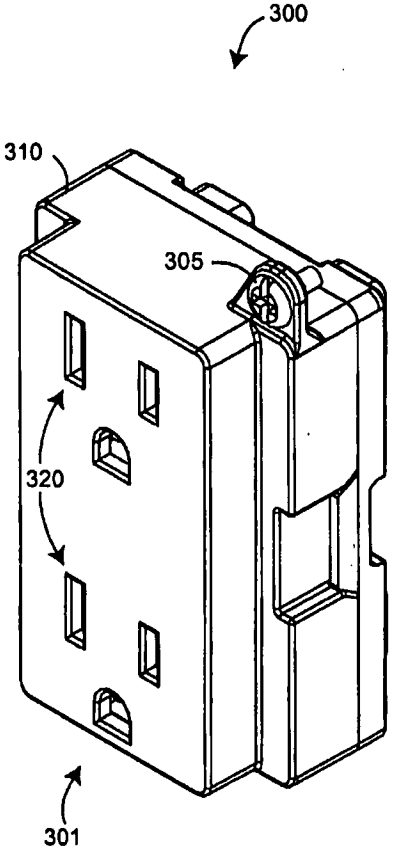


FIG. 3A

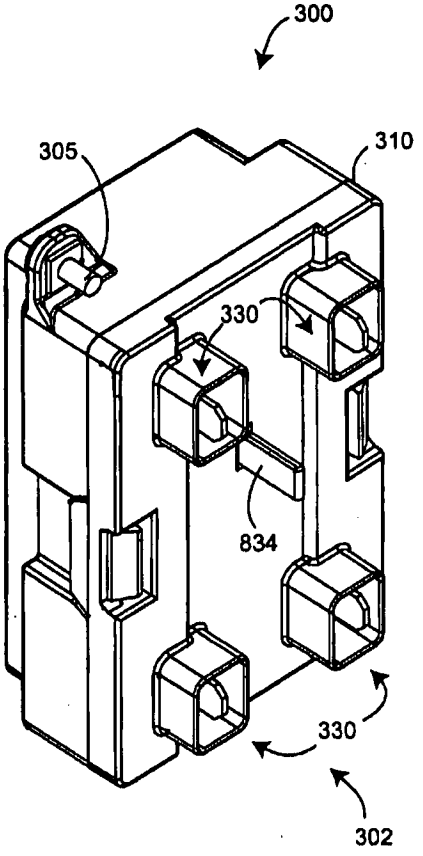


FIG. 3B

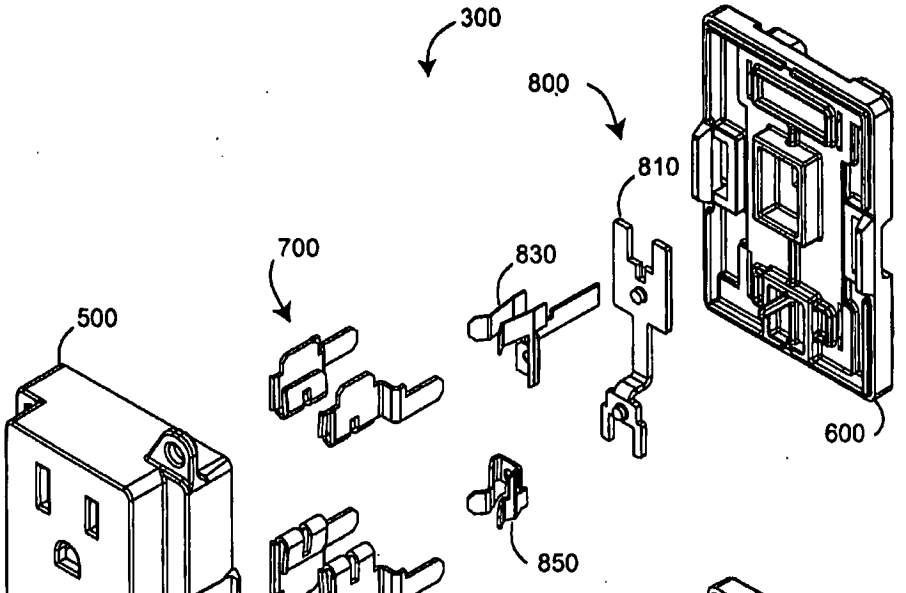


FIG. 4A

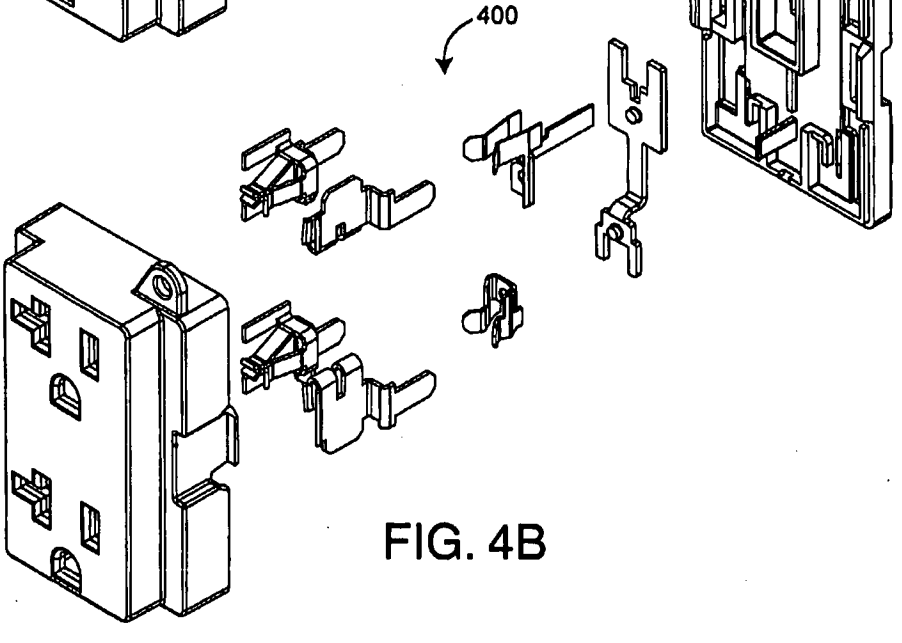


FIG. 4B

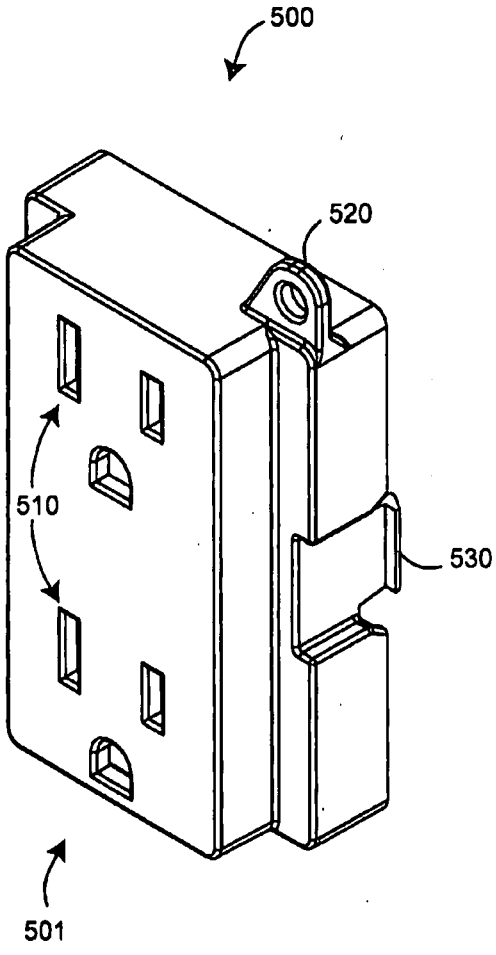


FIG. 5A

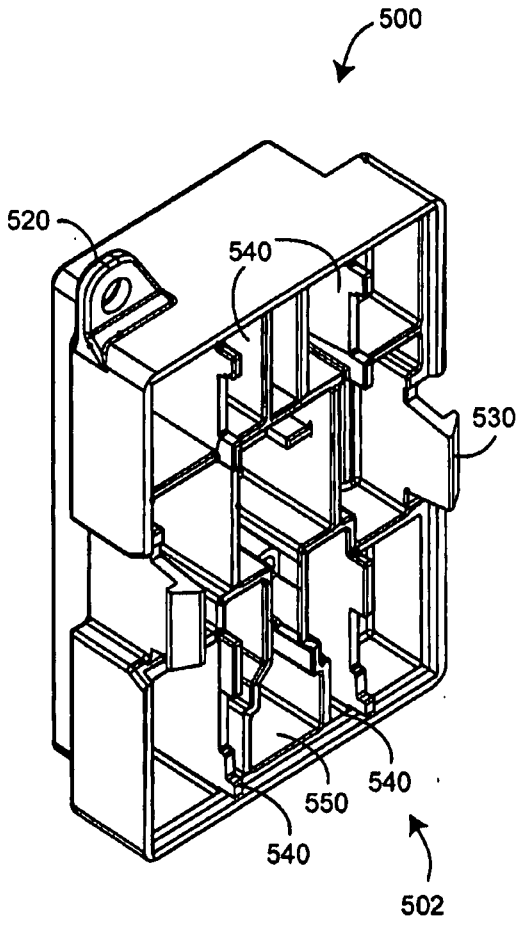


FIG. 5B

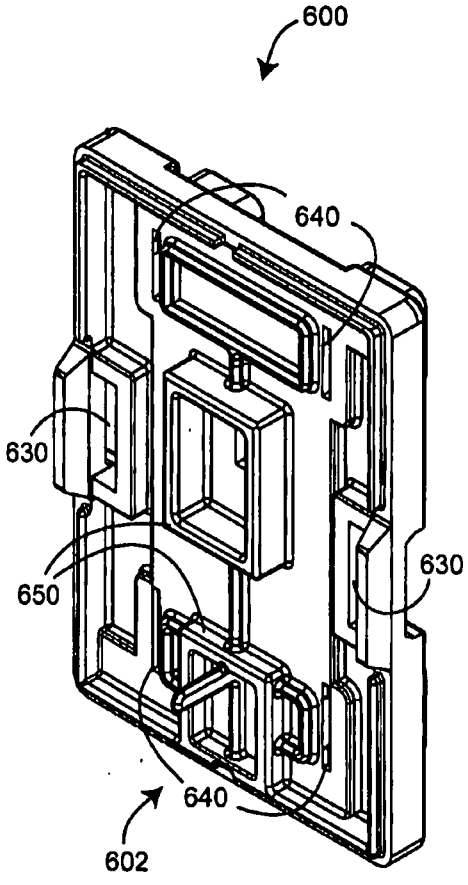


FIG. 6A

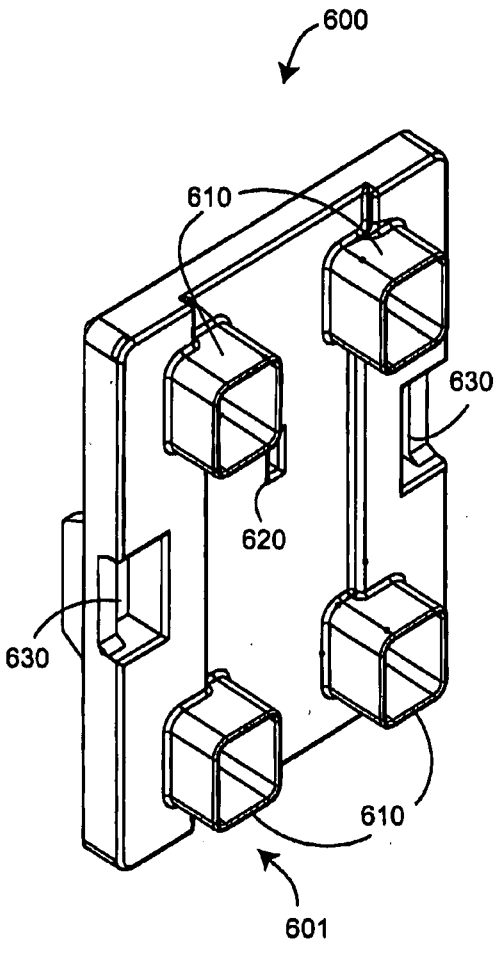


FIG. 6B

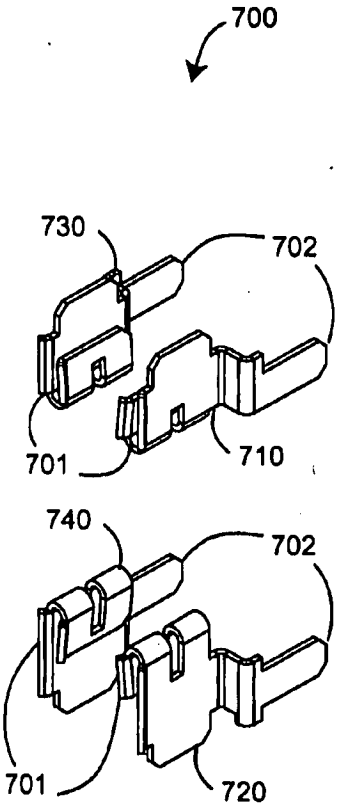


FIG. 7A

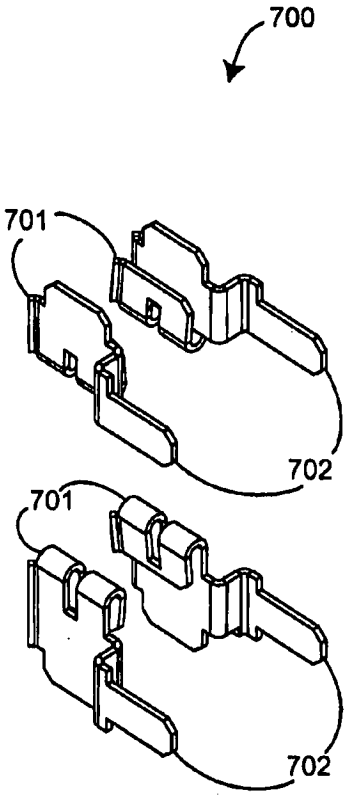


FIG. 7B

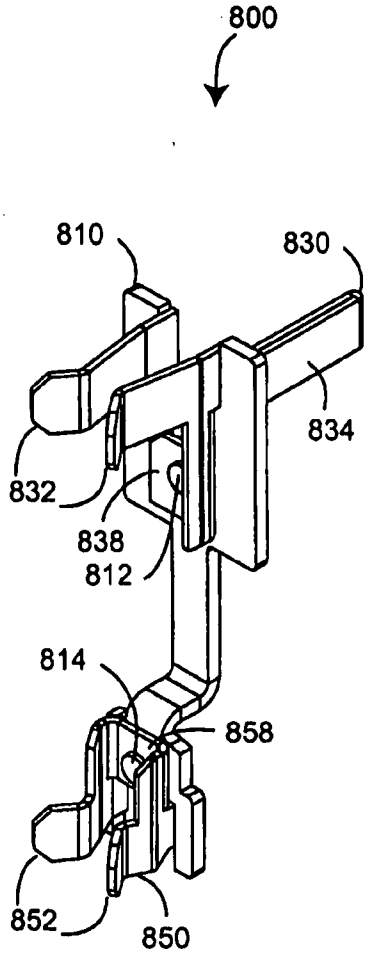

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FIG. 8A

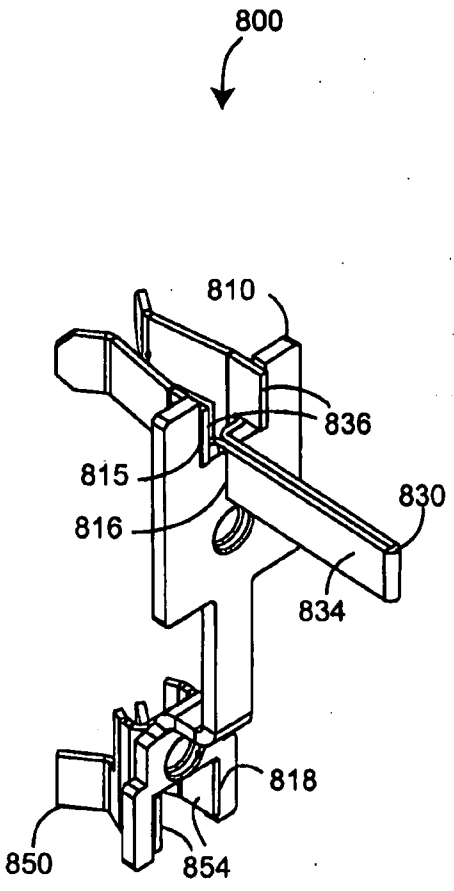
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FIG. 8B

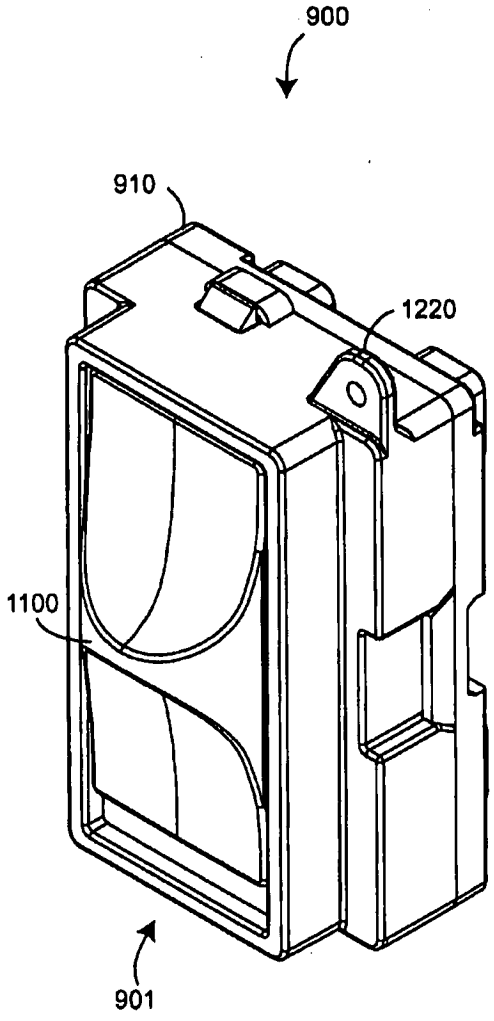

FIG. 9A

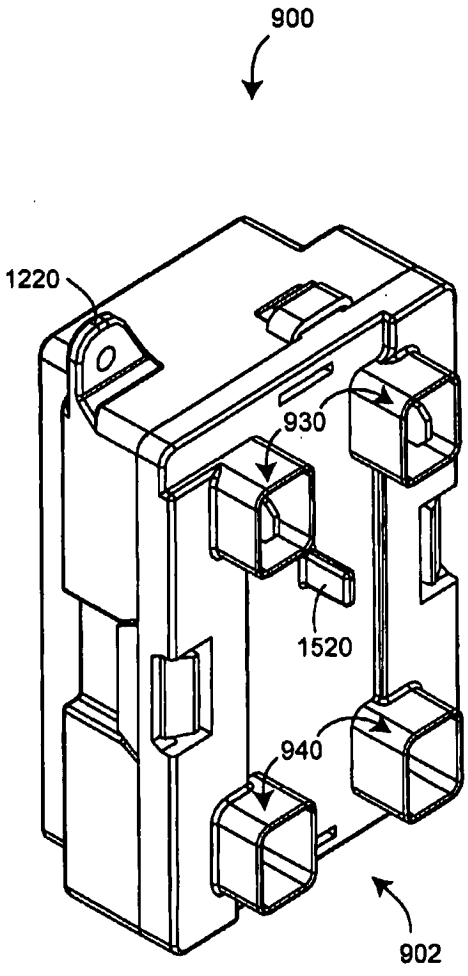

FIG. 9B

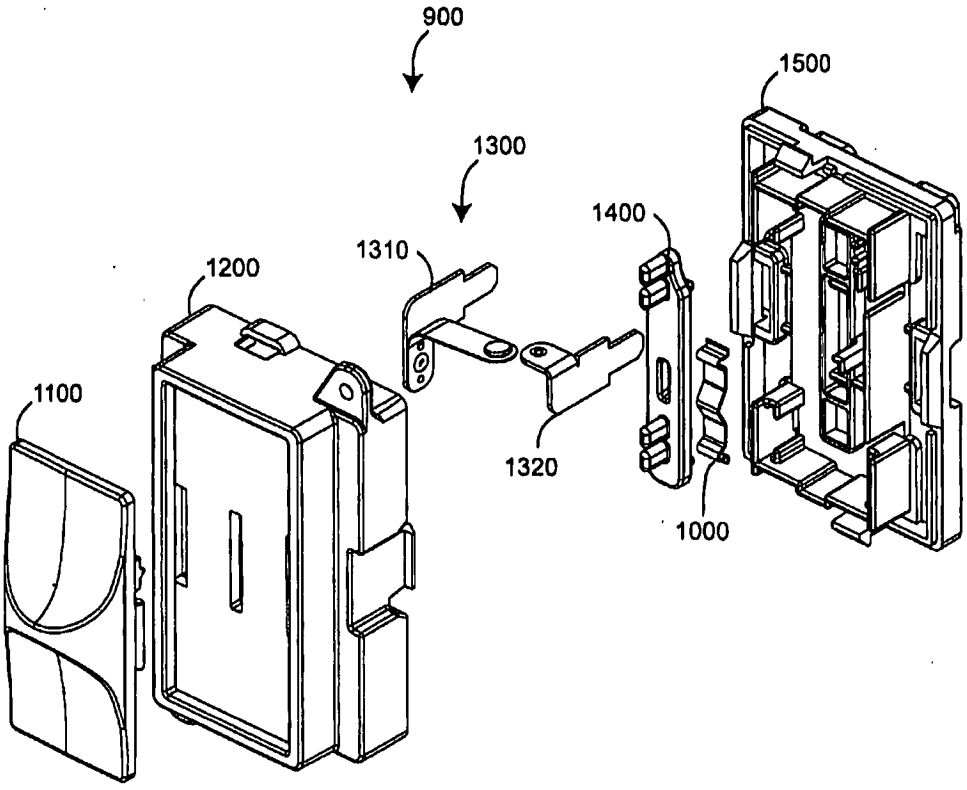

FIG. 10

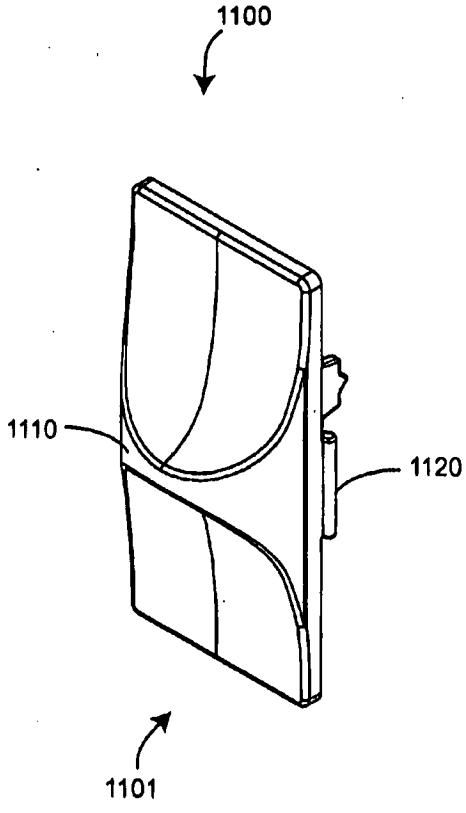

FIG. 11A

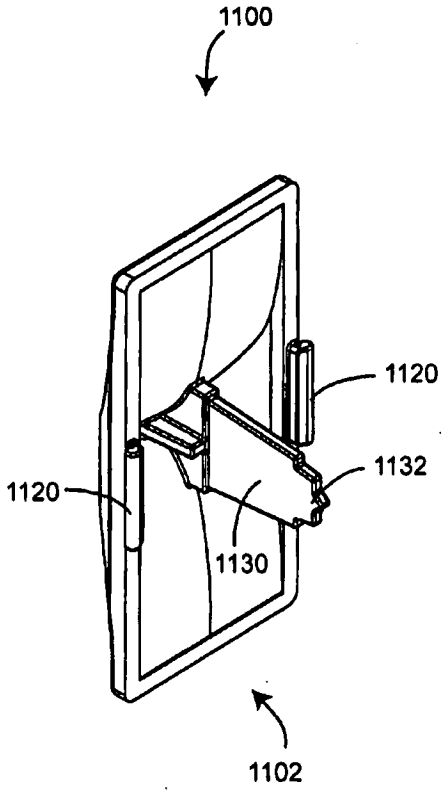

FIG. 11B

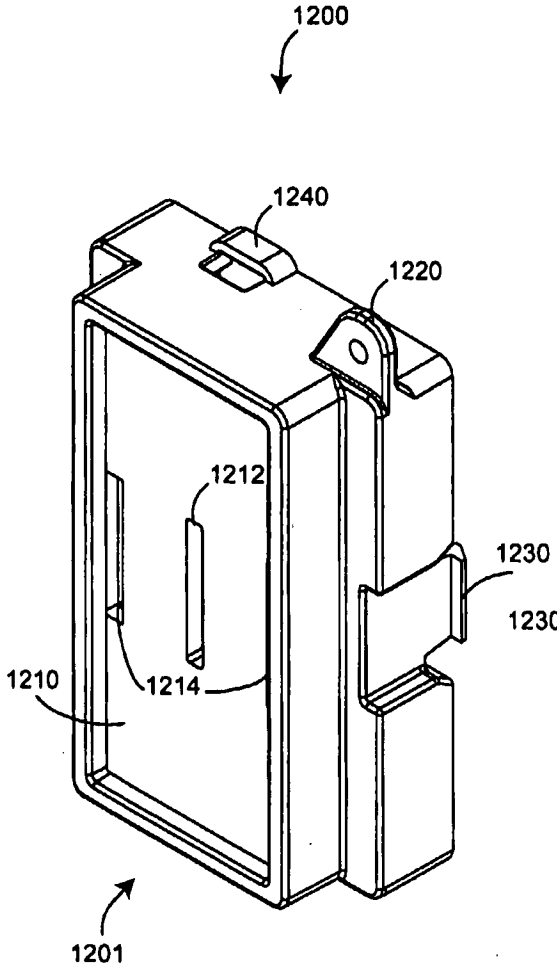

FIG. 12A

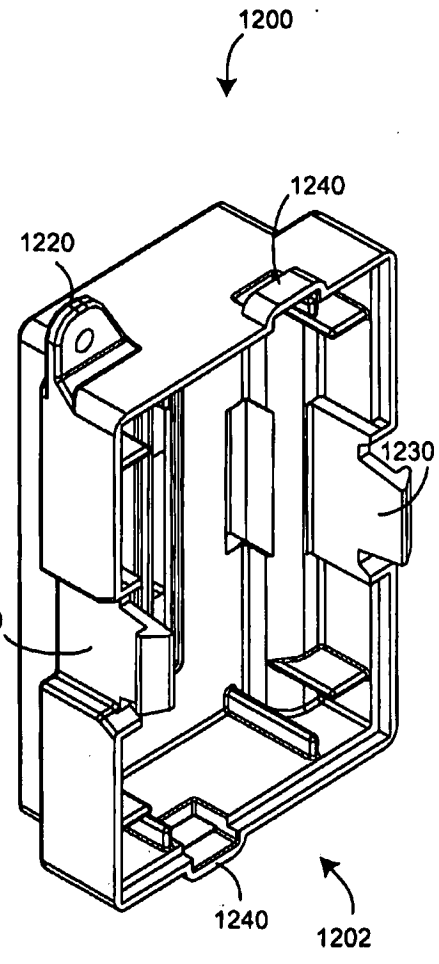

FIG. 12B

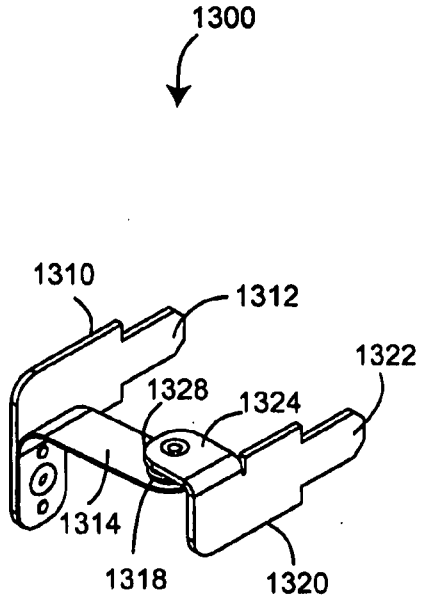

FIG. 13A

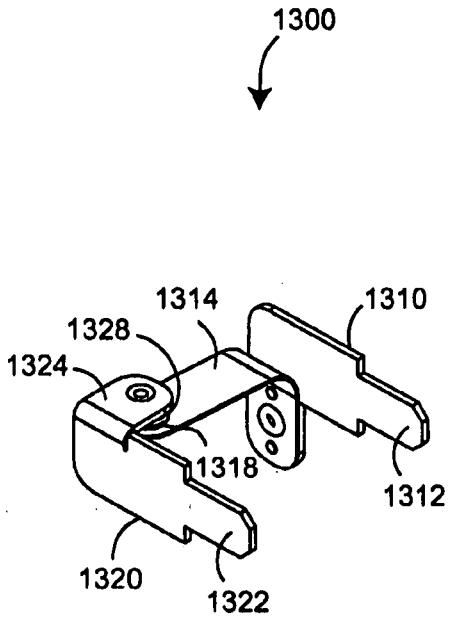

FIG. 13B

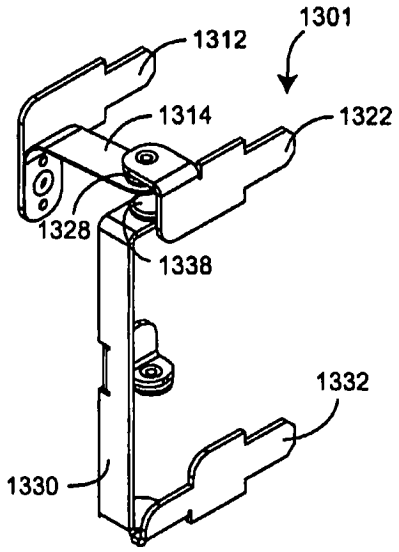

FIG. 13C

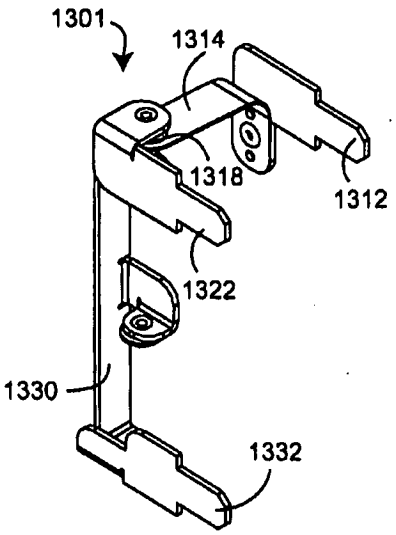

FIG. 13D

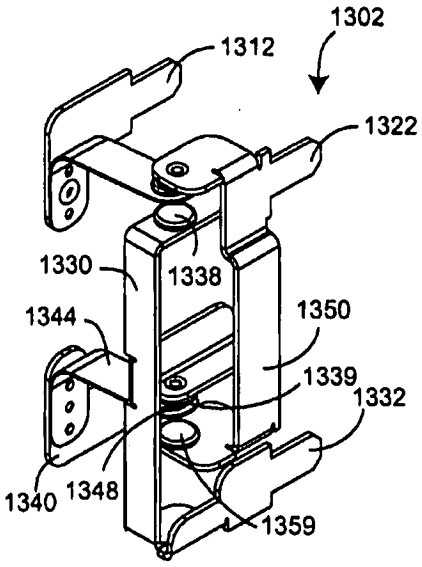

FIG. 13E

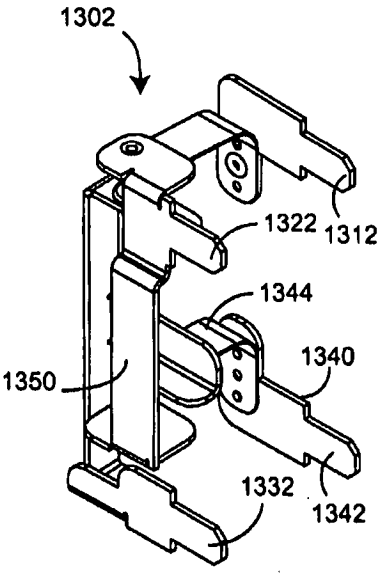

FIG. 13F

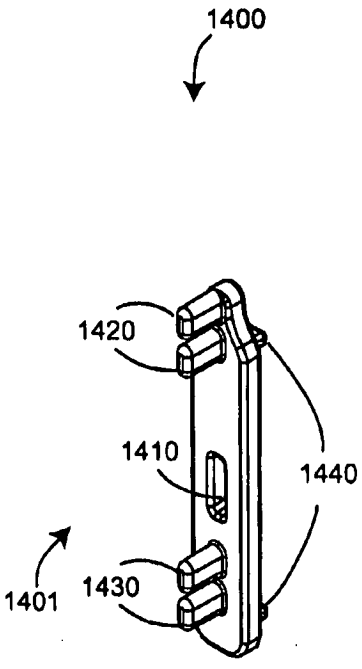

FIG. 14A

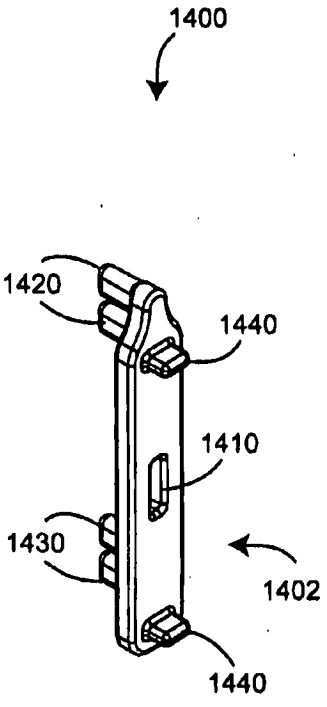

FIG. 14B

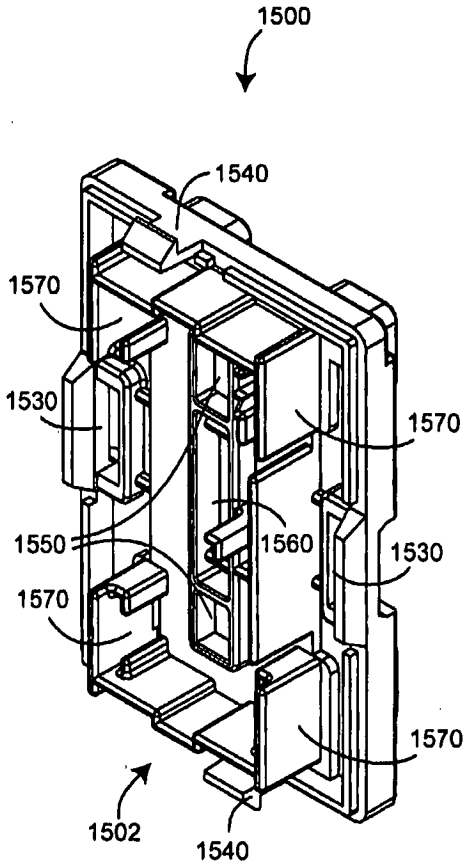

FIG. 15A

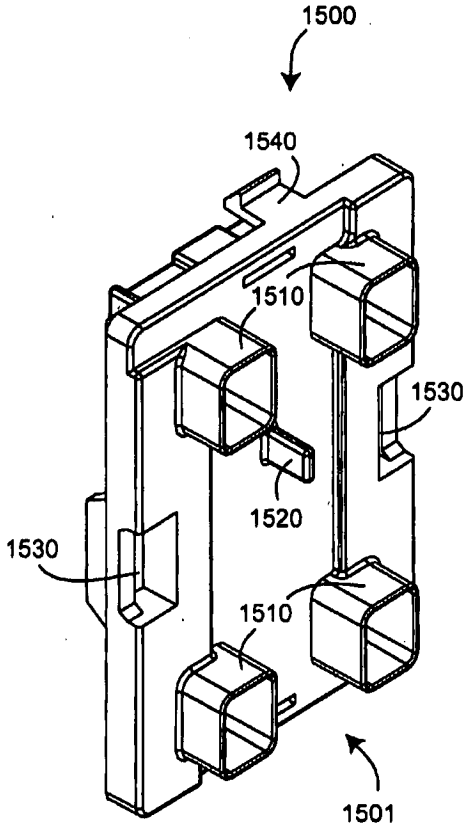

FIG. 15B

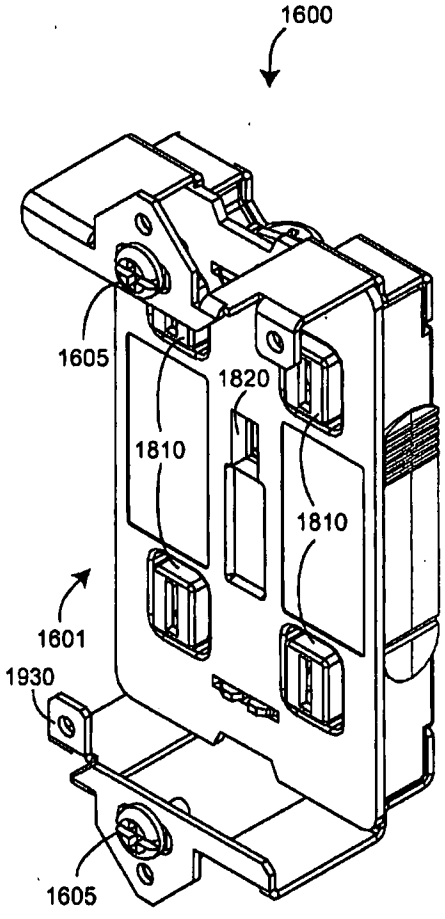

FIG. 16A

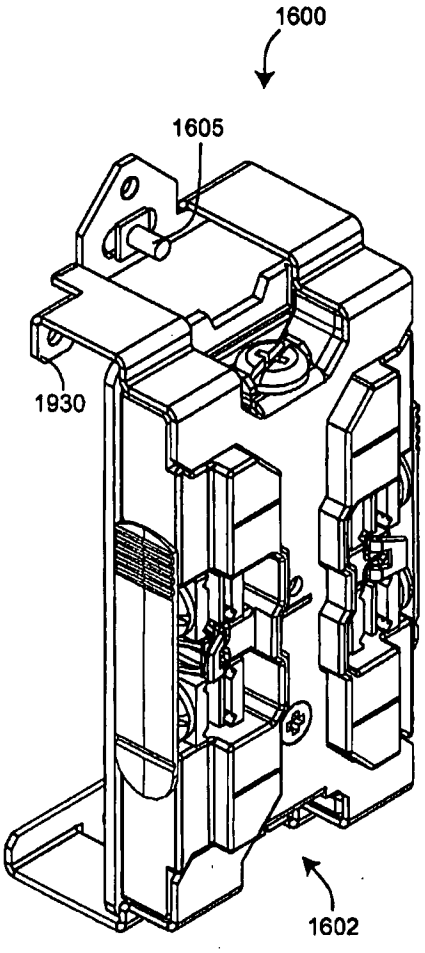

FIG. 16B

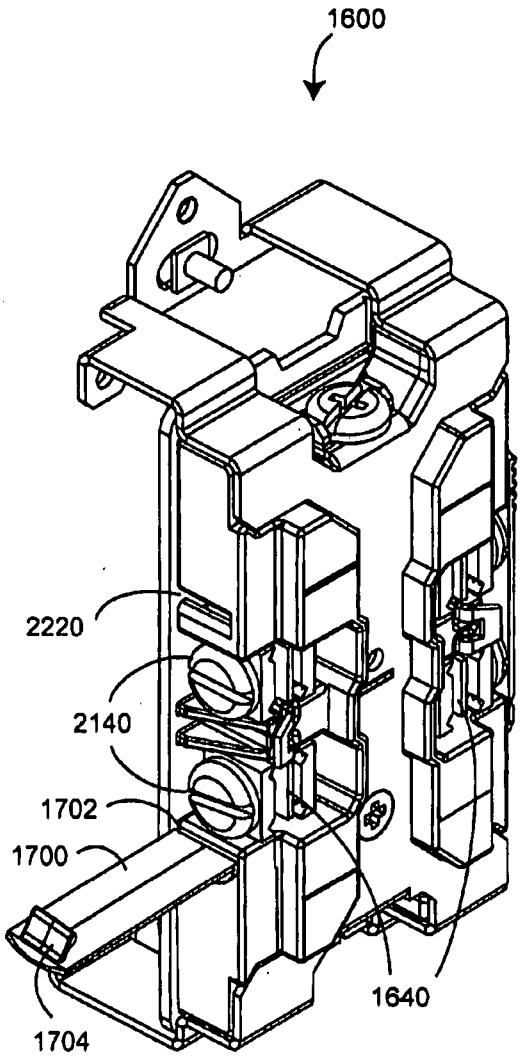

FIG. 16C

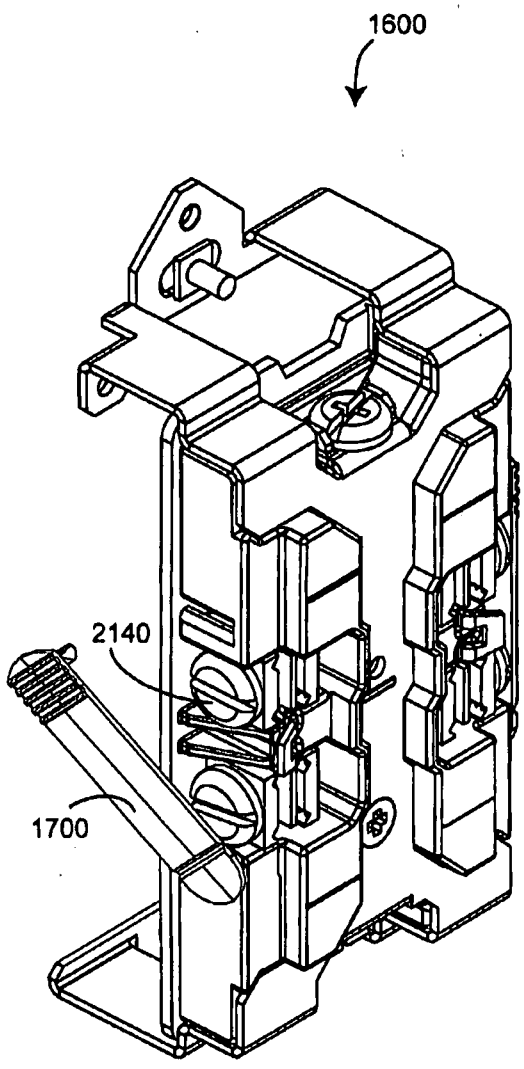

FIG. 16D

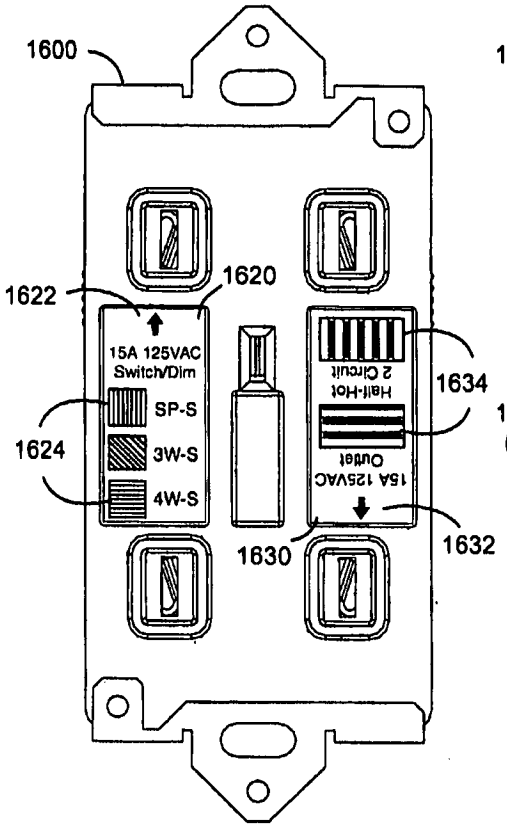

FIG. 16E

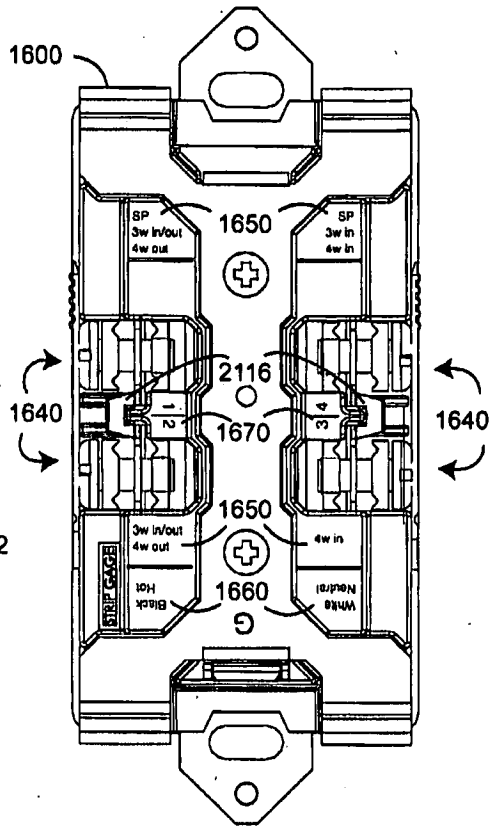

FIG. 16F

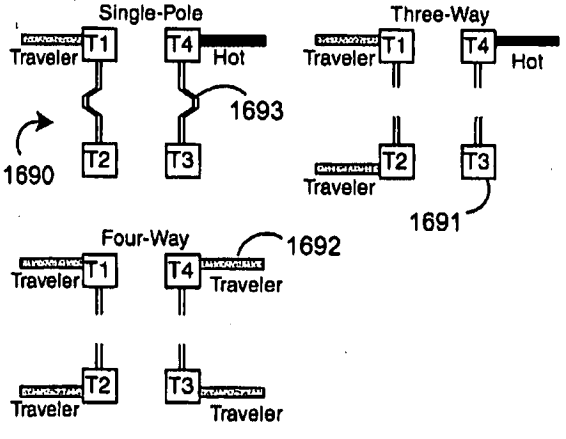

FIG. 16G

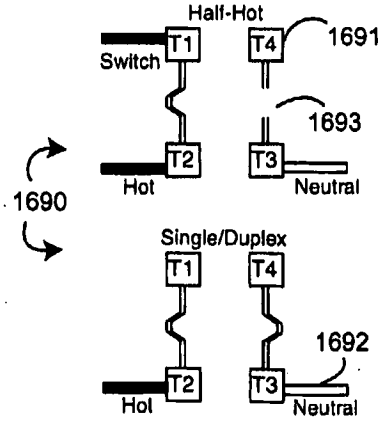

FIG. 16H

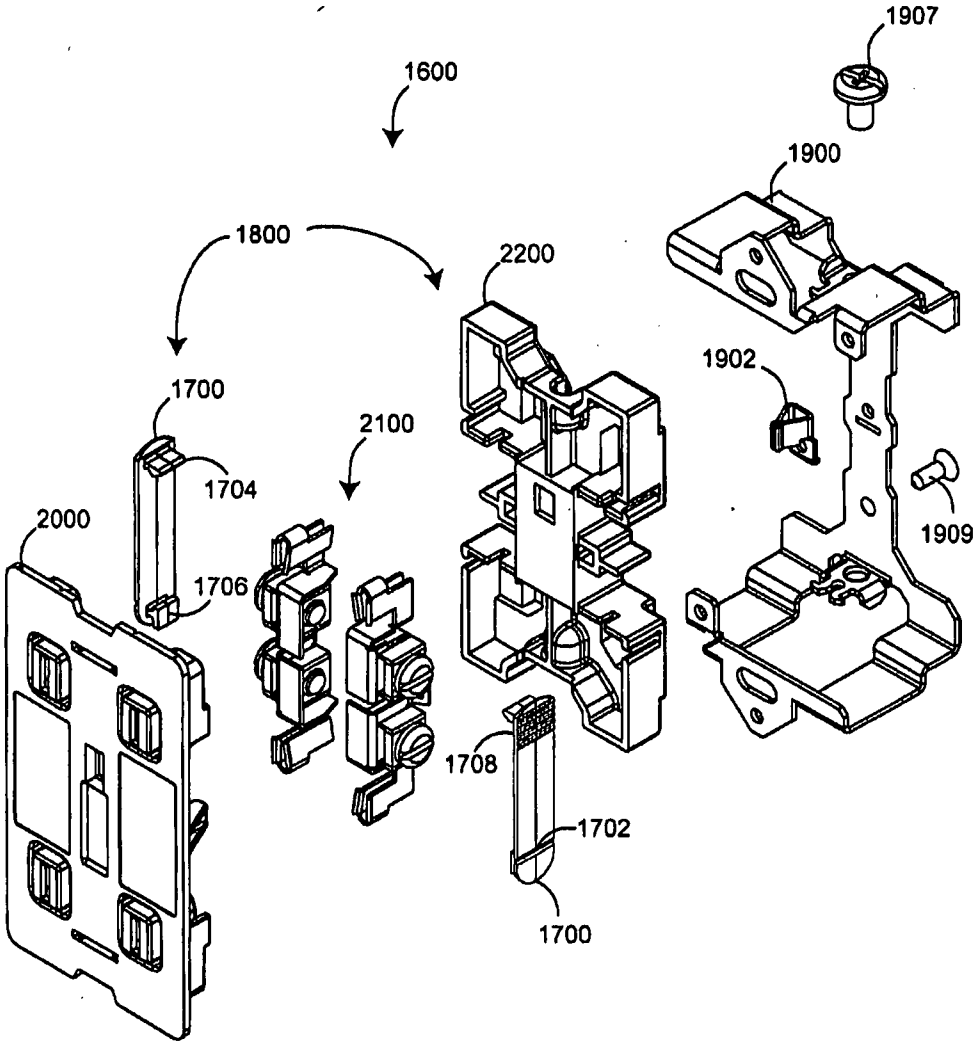
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FIG. 17A

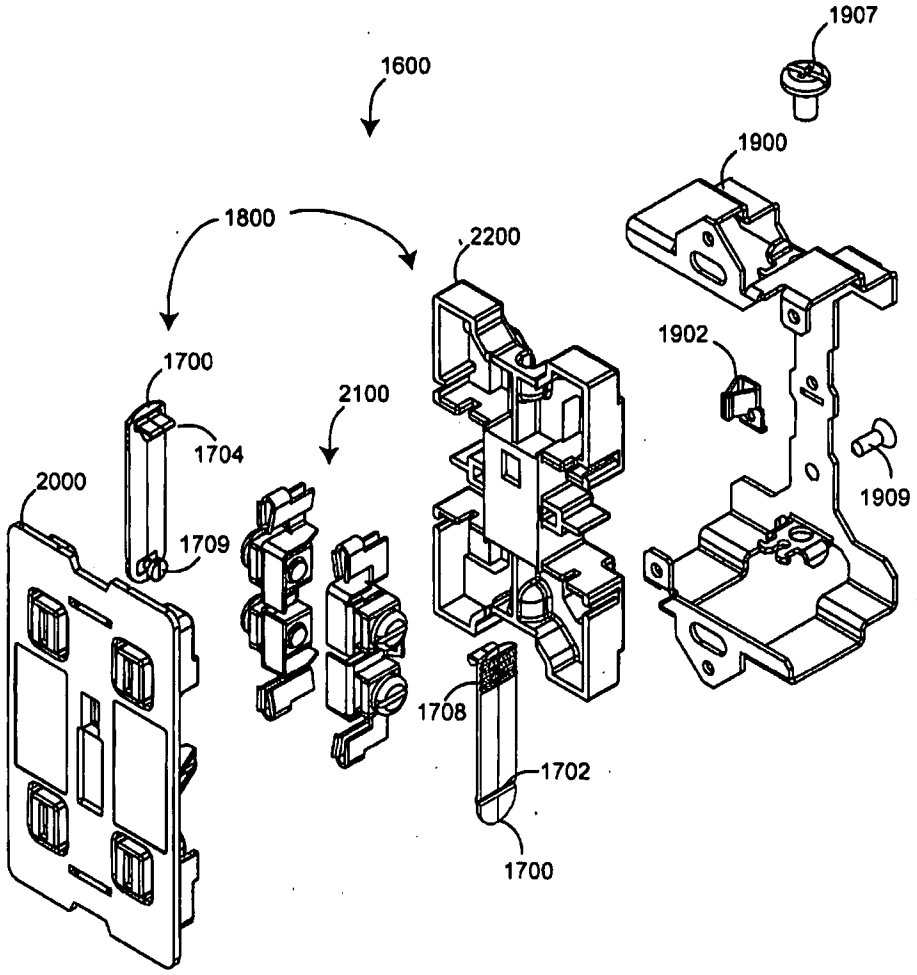
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FIG. 17B

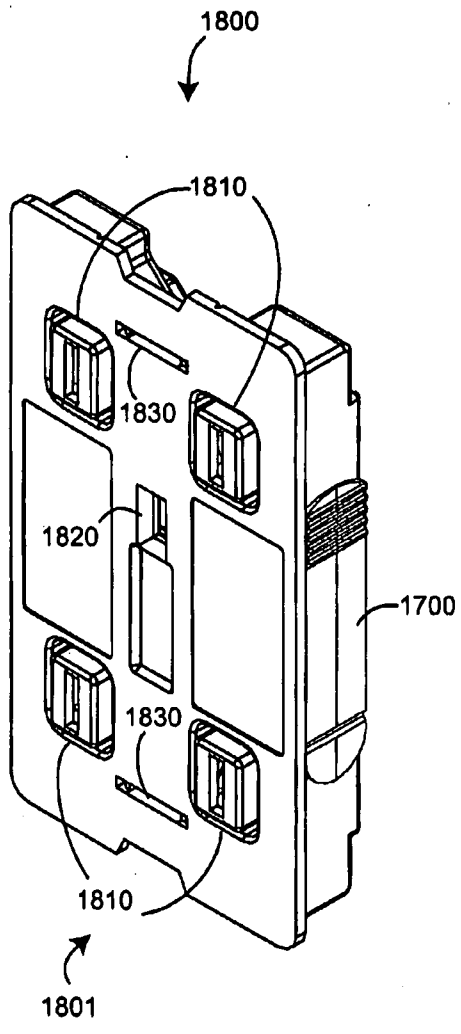

FIG. 18A

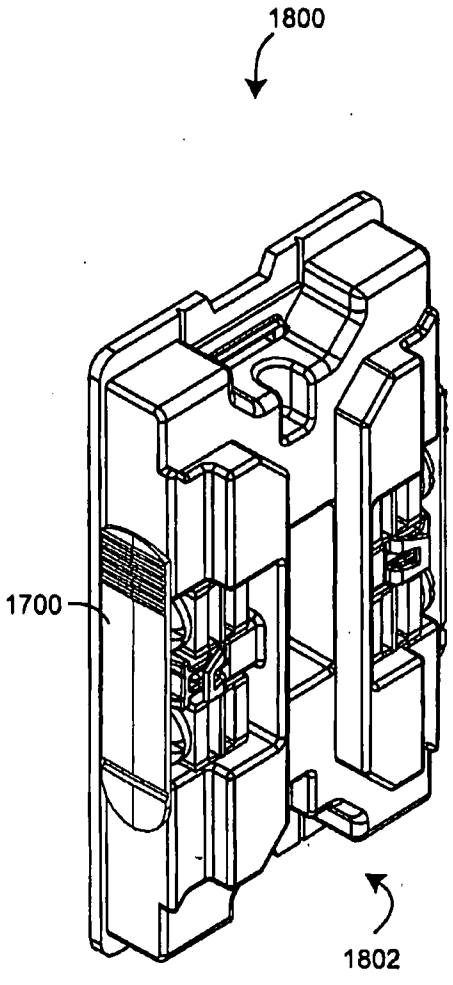

FIG. 18B

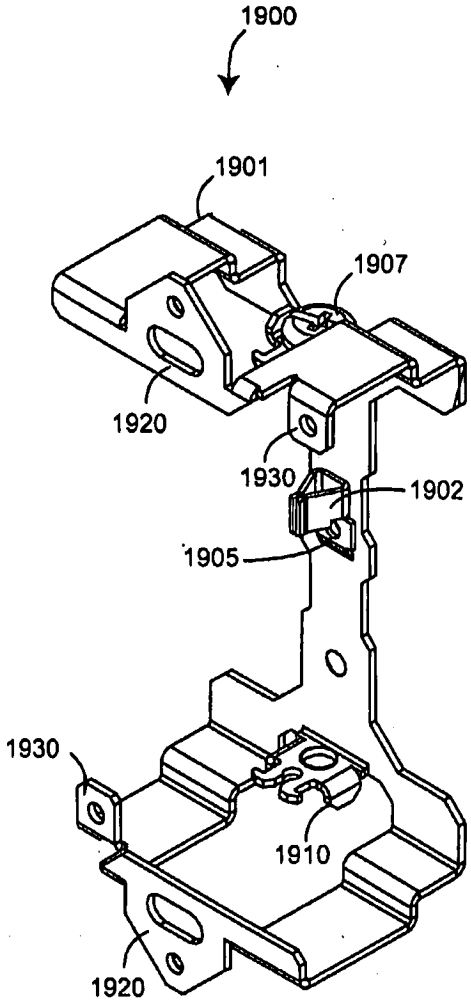

FIG. 19A

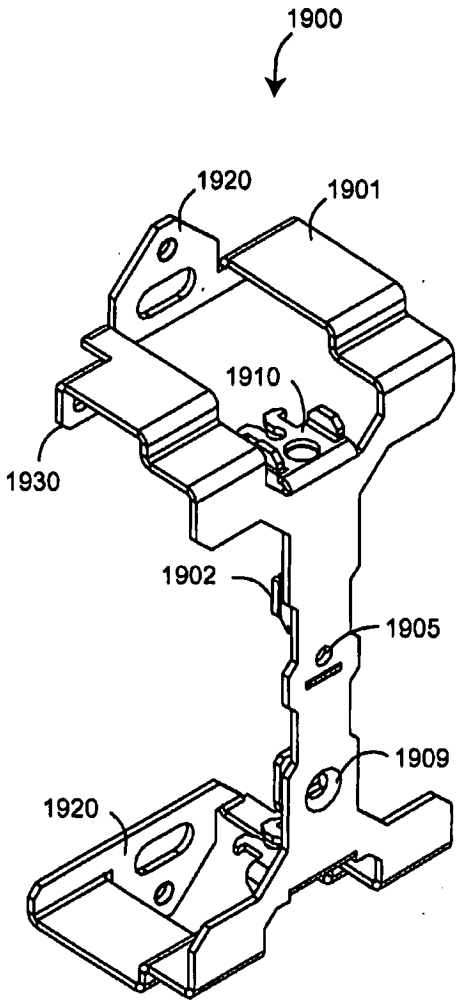

FIG. 19B

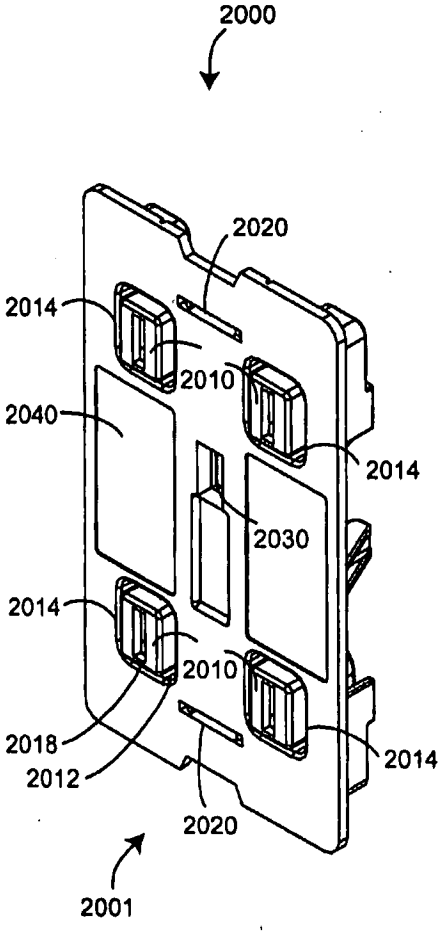

FIG. 20A

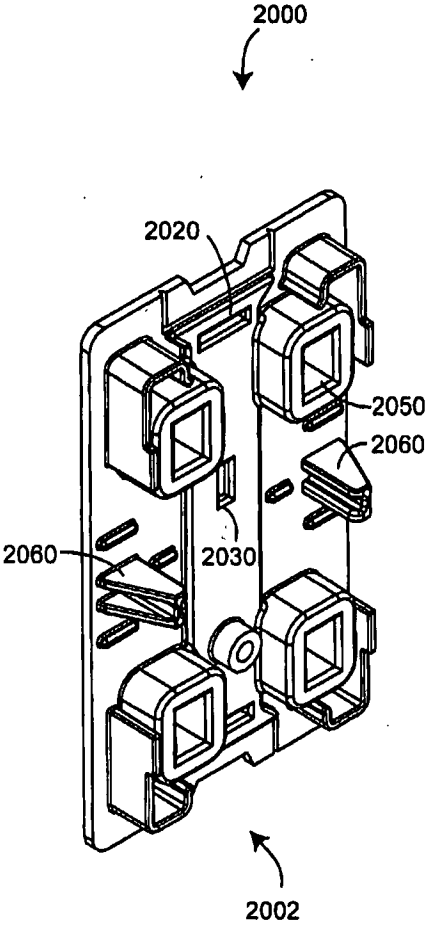

FIG. 20B

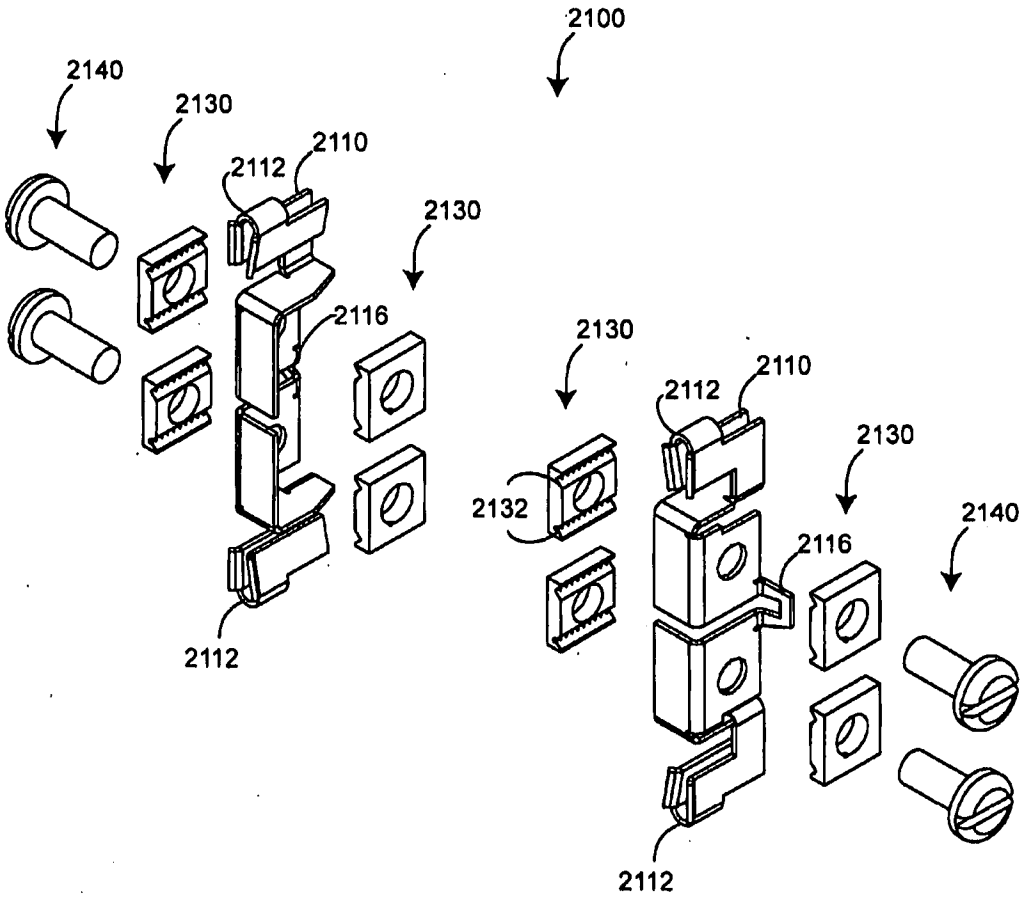
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FIG. 21

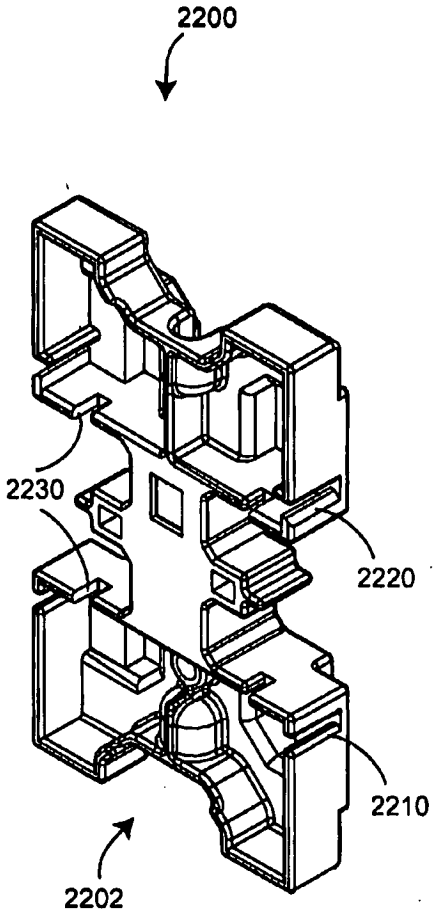

FIG. 22A

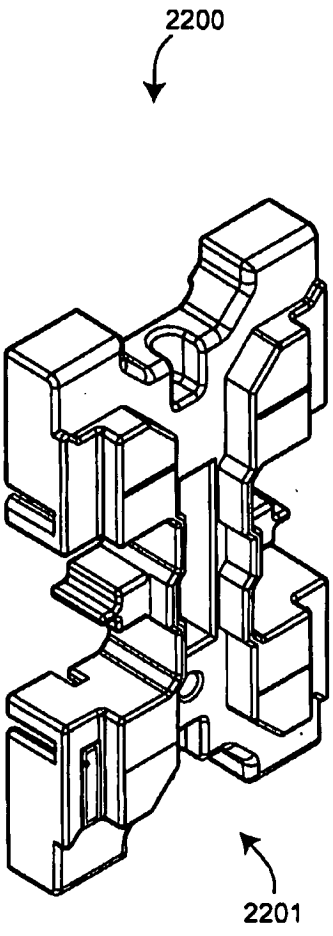

FIG. 22B

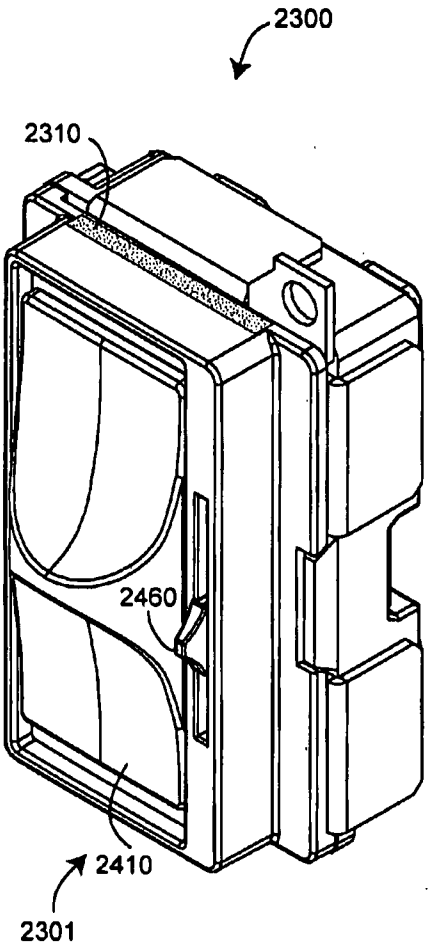

FIG. 23A

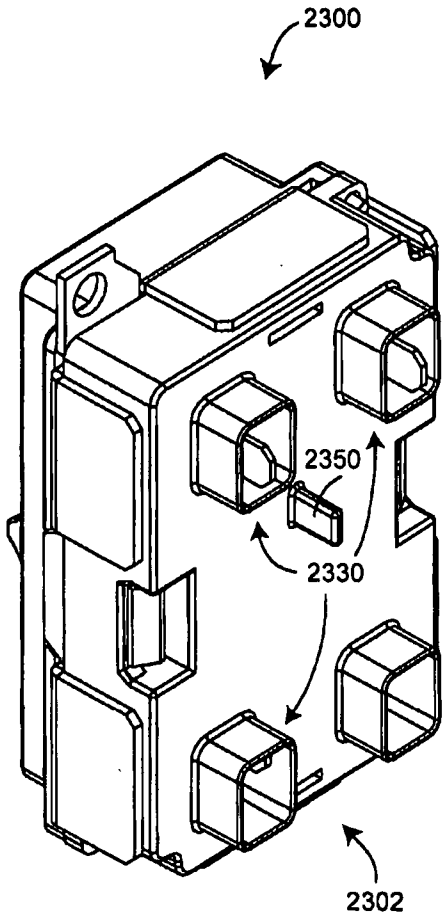

FIG. 23B

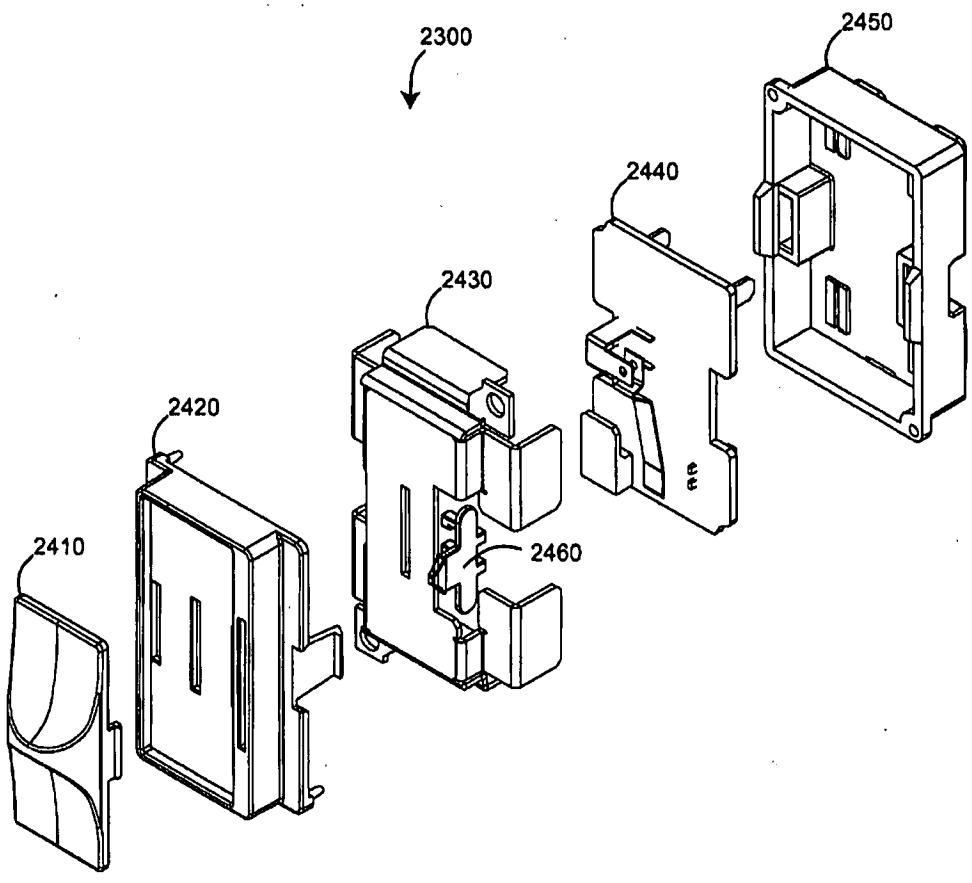

FIG. 24

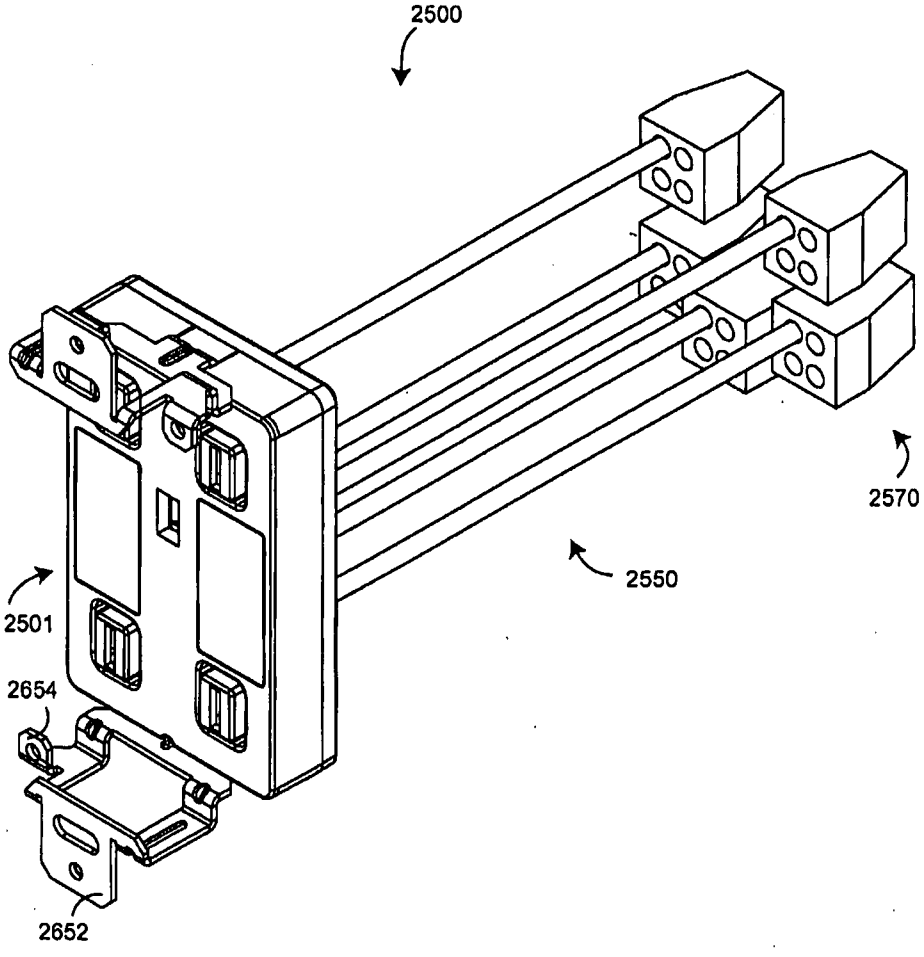

FIG. 25A

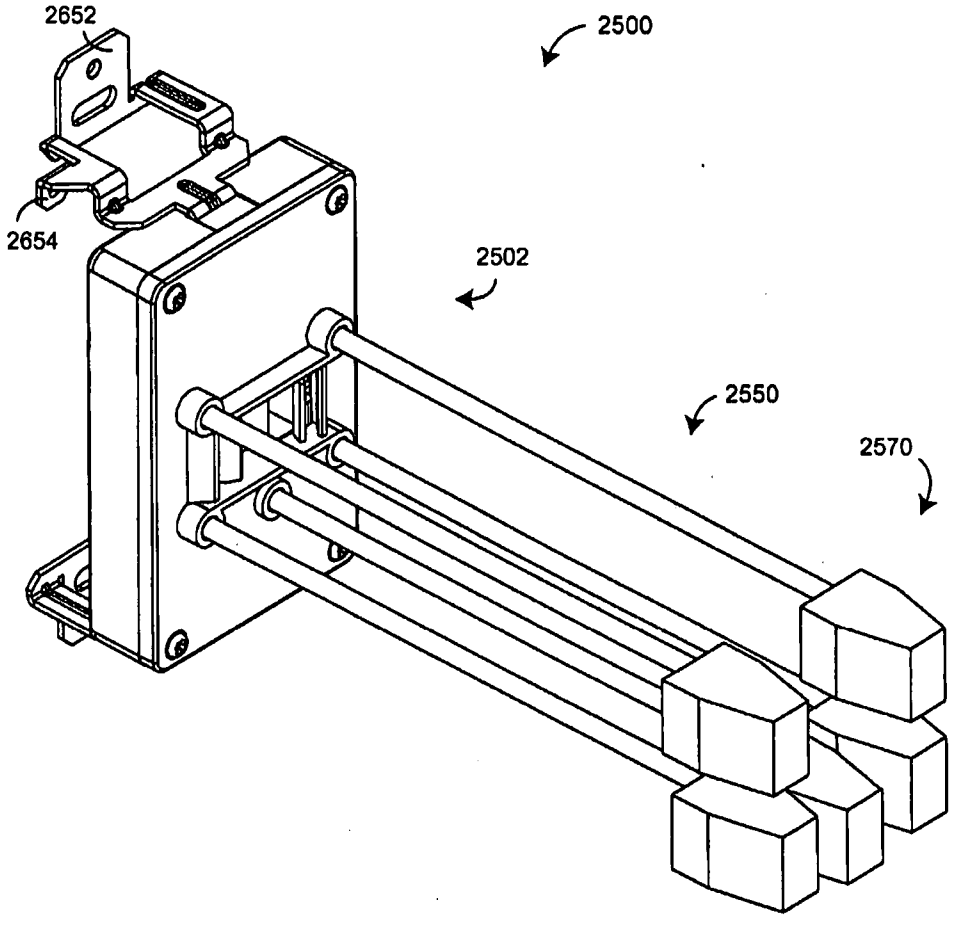

FIG. 25B

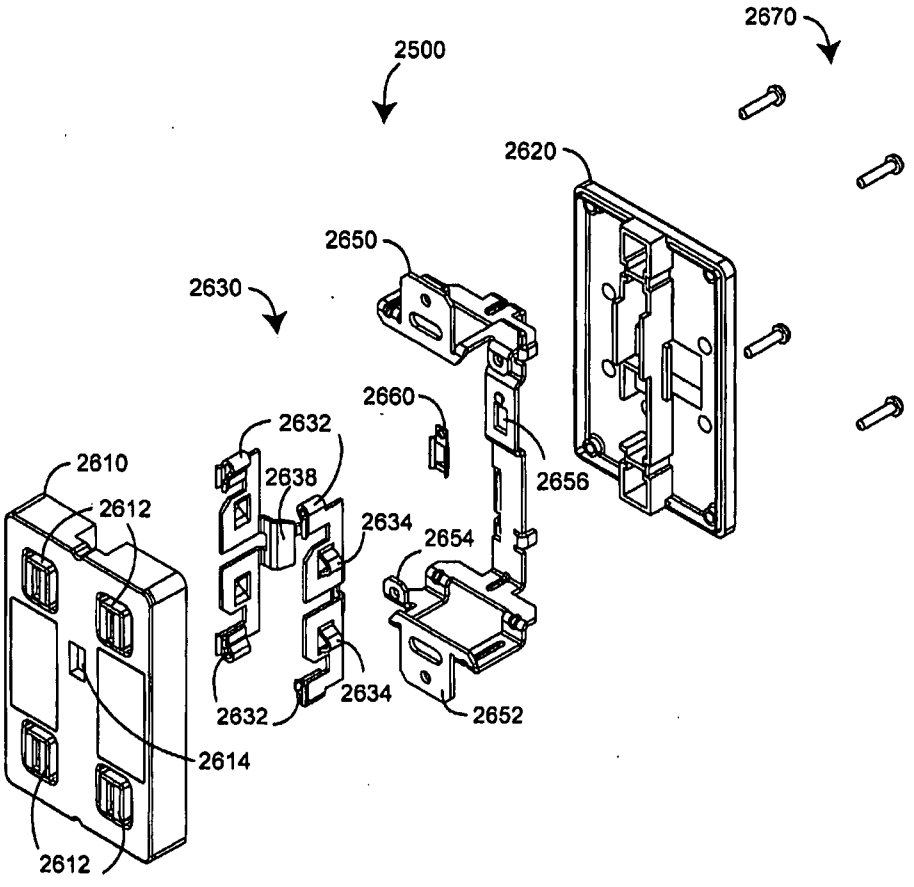
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FIG. 26A

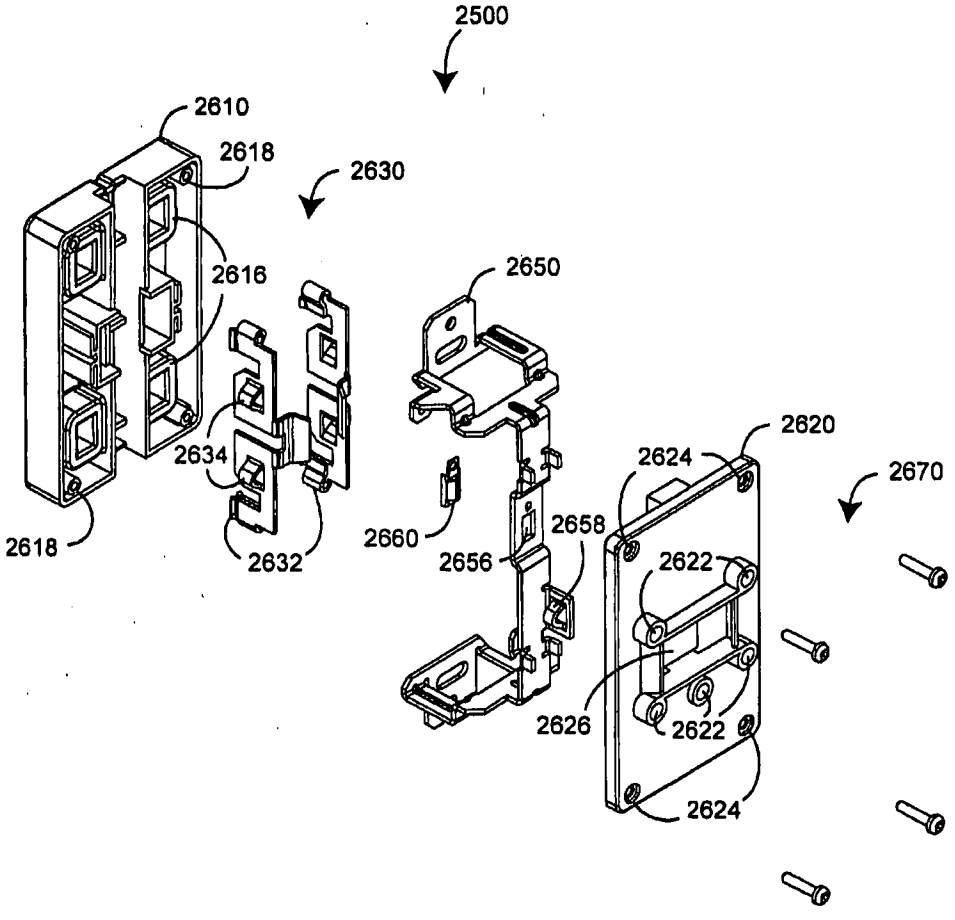
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FIG. 26B

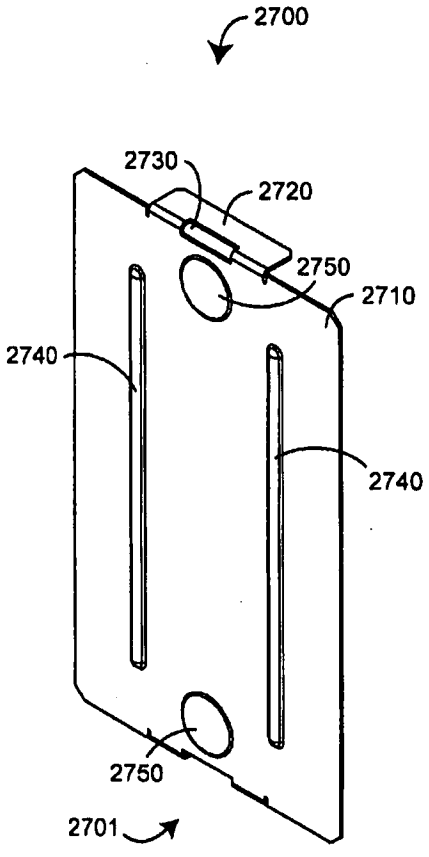

FIG. 27A

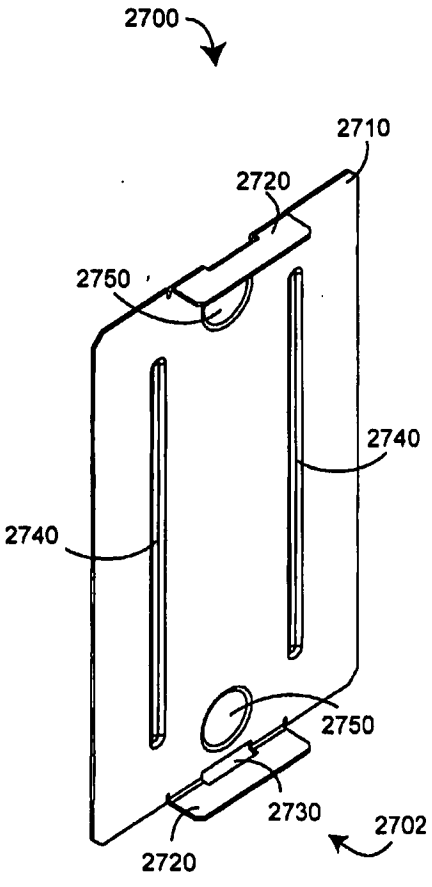

FIG. 27B

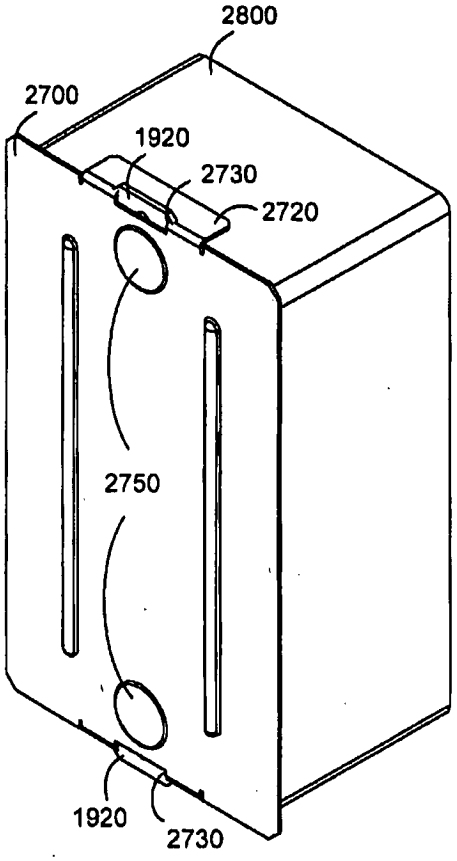

FIG. 28A

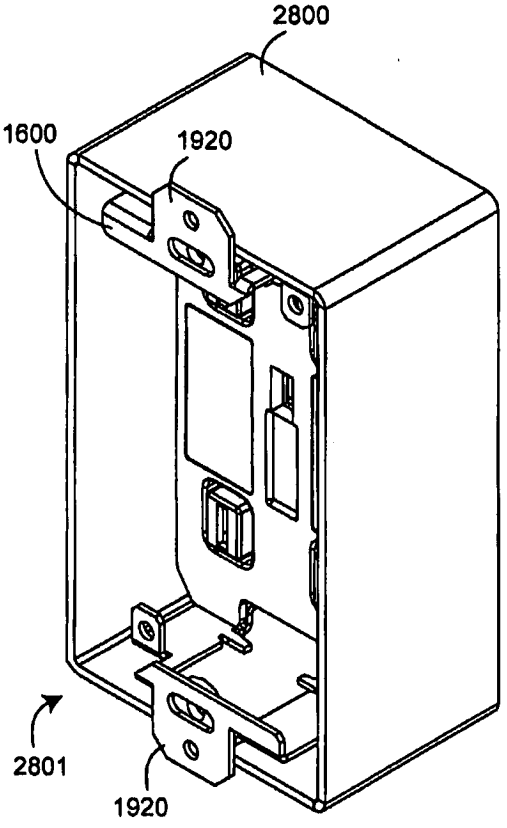

FIG. 28B

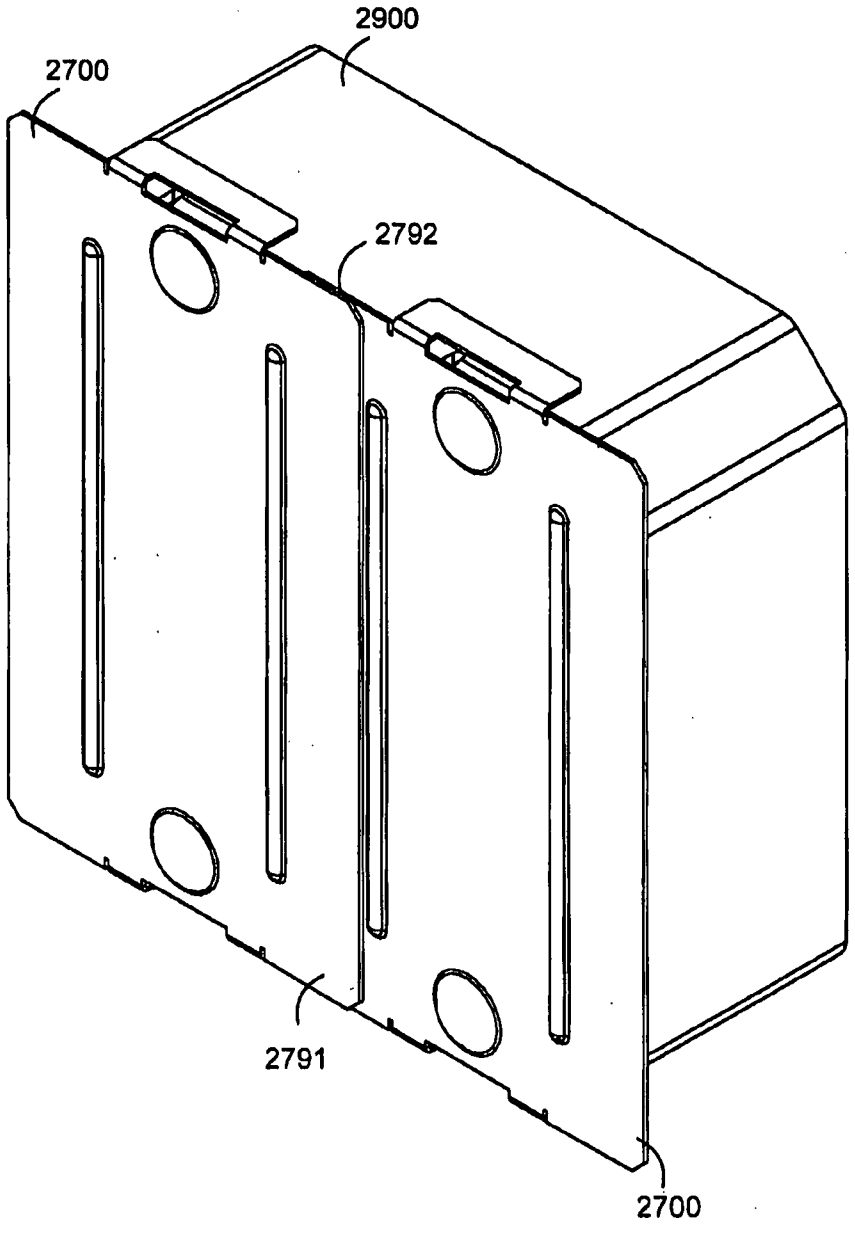

FIG. 29

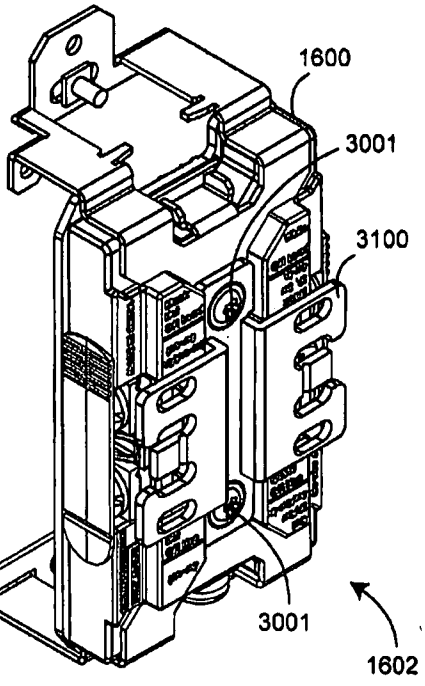

FIG. 30A

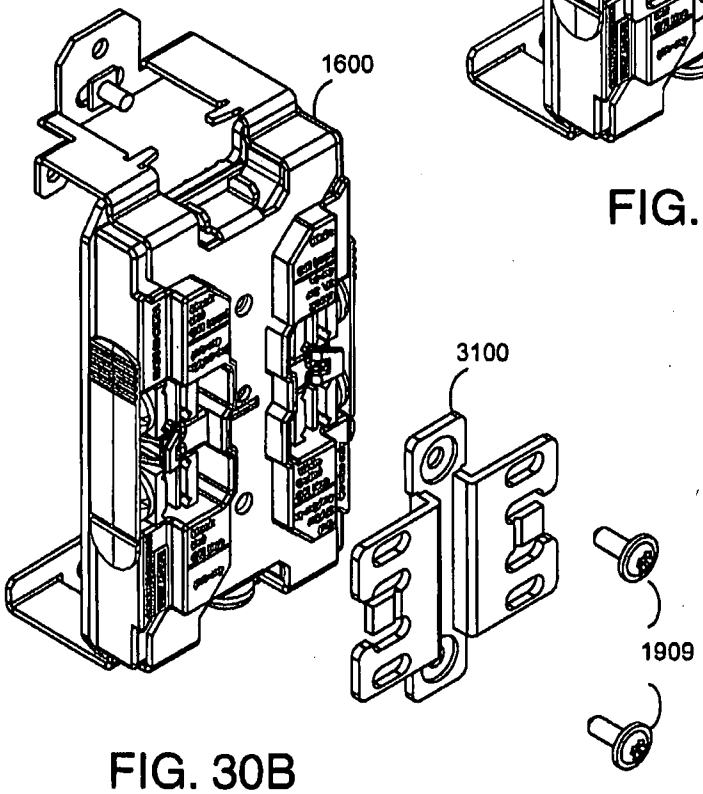

FIG. 30B

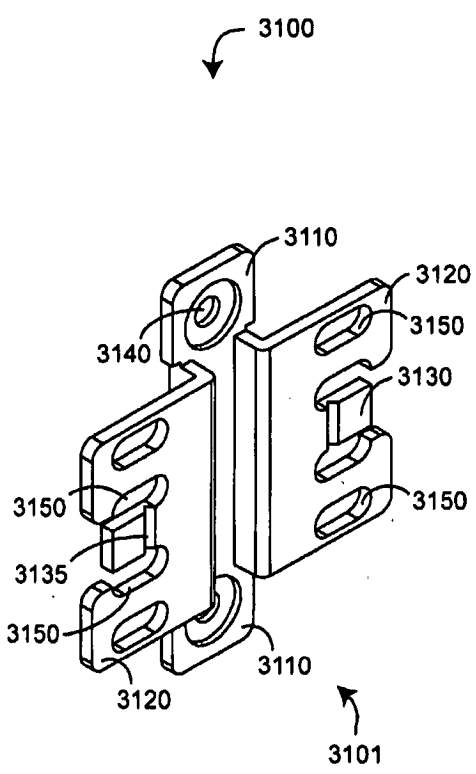

FIG. 31A

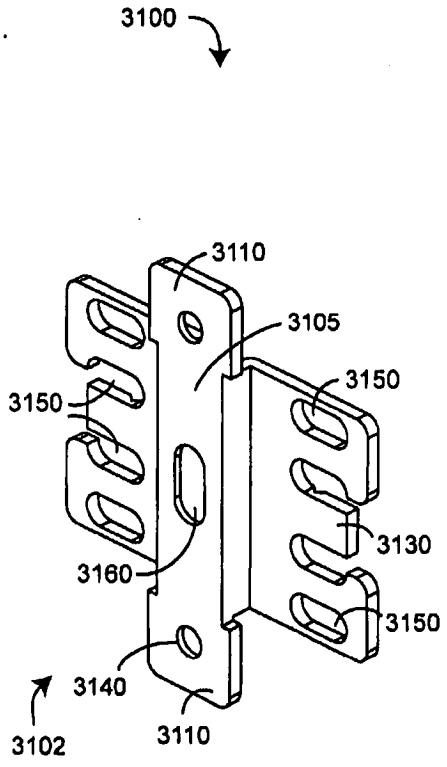

FIG. 31B

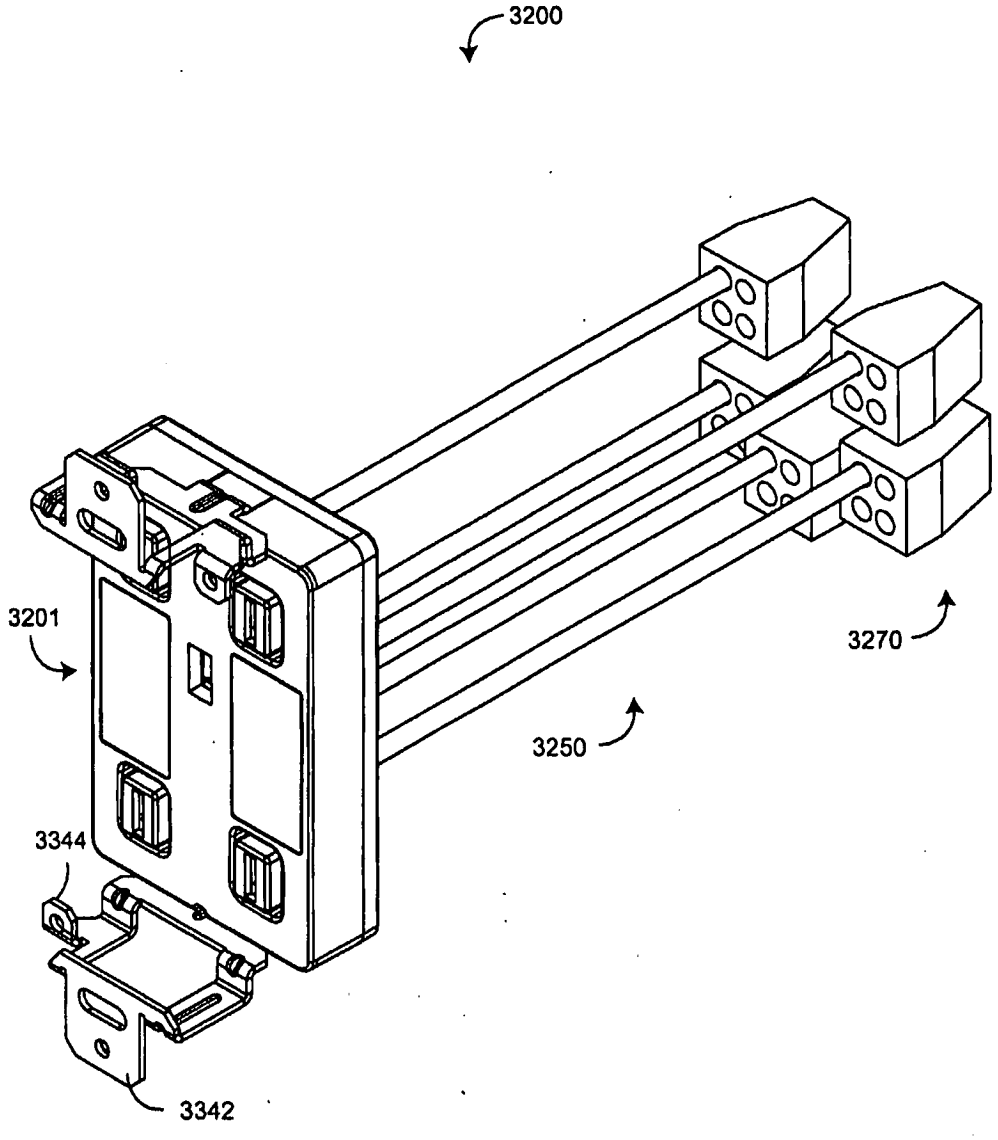

FIG. 32A

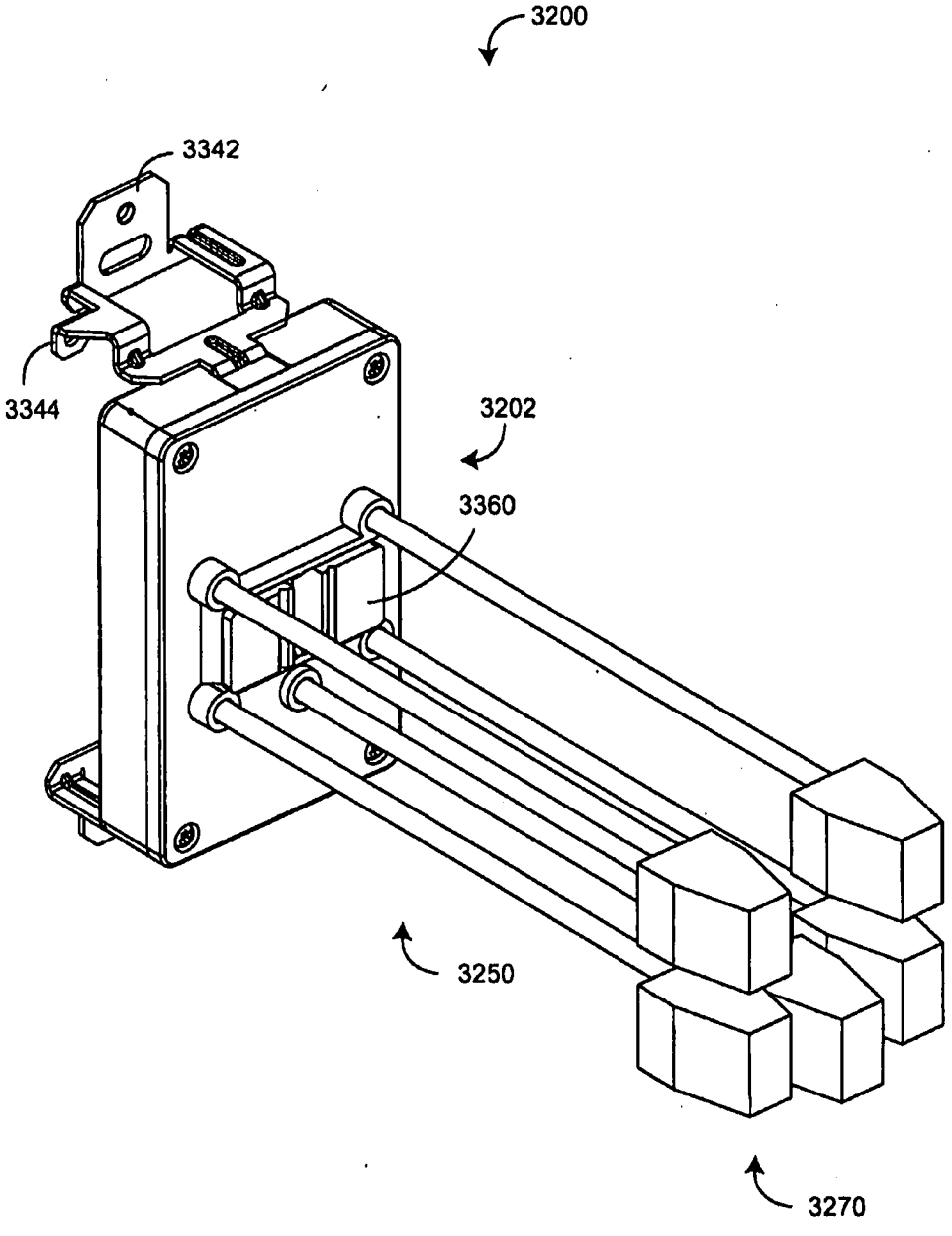

FIG. 32B

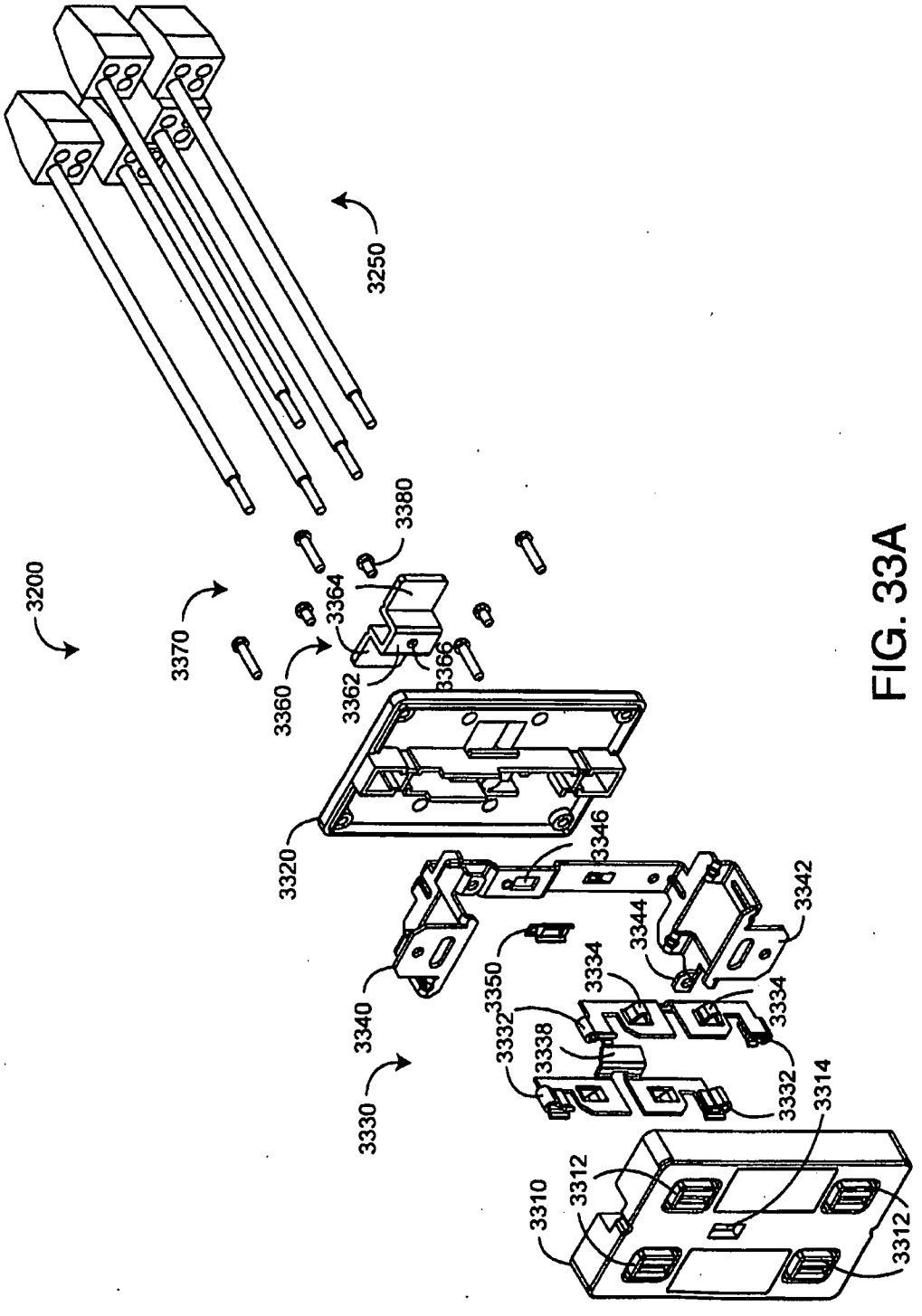
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FIG. 33A

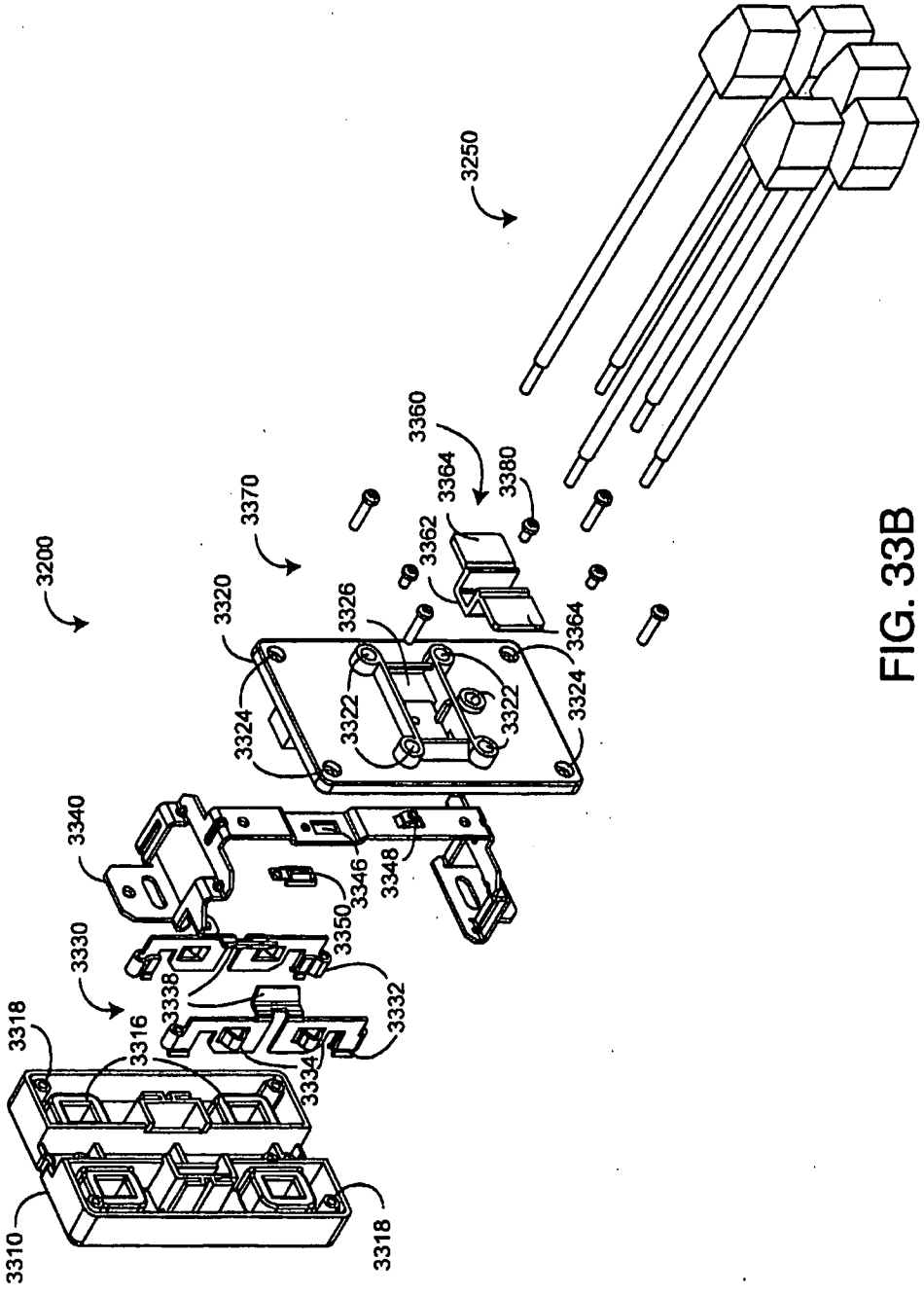
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FIG. 33B

ELECTRICAL DISTRIBUTION WIRING MODULE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application Ser. No. 10/443,444 entitled Safety Module Electrical Distribution System, filed May 22, 2003, which relates to and claims the benefit of prior U.S. Provisional Applications No. 60/383,269 entitled Safety Plug-In Module Electrical Distribution System, filed May 23, 2002, and No. 60/441,852 entitled Safety Module Electrical Distribution System, filed Jan. 21, 2003. This application also relates to and claims the benefit of prior U.S. Provisional Application No. 60/631,244 entitled Sealed Wiring Module, filed Nov. 26, 2004. All of the aforementioned prior applications incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] Standard AC electrical systems are comprised of an electrical box and an electrical device, such as an outlet or switch, installed within the box. During a roughing phase of construction, electrical boxes are mounted to wall studs at predetermined locations. After the boxes are installed, a journeyman electrician routes power cables through building framing to the appropriate boxes. The power cable is fed through openings in the rear or sides of the electrical boxes and folded back into the boxes, unterminated, so as to be out of the way until the next phase. During a makeup phase, wall panels are installed and painted, and the journeyman returns to the construction site to install the electrical devices into the boxes. After conductors are wired to an electrical device, it and the attached conductors are pushed into the electrical box and the device is attached to the top and bottom of the box with screws. During a trim phase, face plates are mounted over the open-end of the electrical boxes, completing the standard electrical wiring process.

SUMMARY OF THE INVENTION

[0003] Standard AC electrical systems are problematic in construction and use, with respect to costs, safety and functionality. From an electrical contractor perspective, a journeyman electrician must make two separate trips to the job site, one for the rough phase and one for the makeup phase. Also, during the makeup phase, installation of the wall panels can damage the work completed during the rough phase. This occurs, for example, when a router contacts exposed cables as drywallers create a hole to accommodate electrical box openings. Another form of damage occurs when drywall compound or paint fouls the exposed cables, insulation and labeling.

[0004] From a general contractor's perspective, verification of the electrical contractor's work is not possible until after the makeup phase. Until then, the electrical cables are unterminated. After the makeup phase, however, miswiring typically requires cutouts in the installed wall panels and associated patches after corrections are completed. Further, the electrical system cannot be activated until after verification. Thus, during the rough and makeup phases, electricity for tools and lighting must be supplied by generators, which create hazards due to fumes, fuel, and noise and are an unreliable electrical source. In addition, until the trim phase is completed, unskilled personnel have access to the electrical cable. Tampering can compromise the integrity of the electrical wiring and also create a safety problem after power is activated.

[0005] From a homeowner's perspective, there are problems with repair of the standard electrical wiring. Replacement of a broken outlet or switch device first requires removal of a face plate. The screws that attach the module to the top and bottom of the electrical box must be removed next. The device is then removed from the box and the conductors are removed by loosing the screws on the outlet sides. The process is then reversed to attach the conductors to a new device and mount the new device into the electrical box.

[0006] The prior art electrical device replacement procedure described above exposes the homeowner to AC wiring upon removal of the face plate. This exposure creates a shock hazard. Further, a homeowner's reluctance to change out broken devices or to spend the money to hire an electrician also creates a shock and a fire hazard from continued use of cracked, broken or excessively worn outlets or switches. In addition, the integrity of the original wiring becomes questionable if a homeowner or other third party removes and replaces an electrical device. Miswiring by a third party can violate building codes and create shock and fire hazards, such as inadvertently switching the hot and neutral conductors, failing to attach ground wires, kinking or nicking conductors or improperly tightening connections.

[0007] An electrical distribution wiring module benefits the electrical contractor in several respects. The wiring module is installed internally to an electrical box and associated functional modules are removably installed into the wiring module without exposure to or access to electrical system wiring attached behind the panel. The journeyman's work can complete at the rough phase, when installation of the wiring module is complete. Thus, there is no need for the journeyman to return to the job site during the makeup phase because any semi-skilled laborer can insert, for example, an appropriate outlet or switch module. Further, there is no wiring access after the rough phase, protecting wiring integrity. Also, there are no exposed conductors or parts inside the electrical box that can be inadvertently damaged during wall panel installation.

[0008] An electrical distribution wiring module also benefits the general contractor. Because wiring is completed during rough framing, verification and activation of the building electrical system can be performed at the rough phase. Miswiring can be corrected before wall panels are installed and painted, eliminating cut and patch repairs. Early electrical system activation eliminates the need to use generators. Lack of third party access to the journeyman's wiring preserves integrity after verification and eliminates shock exposure to other workers.

[0009] An electrical distribution wiring module also benefits the homeowner. Replacement of broken sockets and switches can be easily and safely accomplished. Safety is enhanced by reducing exposure to electrical wiring and encouraging replacement of defective outlets and switches. Further, maintenance costs are reduced by reducing the need to hire an electrician for repairs. Wiring integrity is insured by reducing the opportunity of unqualified third parties to access the electrical system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIGS. **1A-B** are perspective views of an outlet module installed and removed, respectively, from a corresponding wiring module;

[0011] FIGS. **2A-B** are perspective views of a switch module installed and removed, respectively, from a corresponding wiring module;

[0012] **FIGS. 3-8** are perspective views of an outlet module and outlet module components;

[0013] FIGS. **3A-B** are front and back perspective views, respectively, of an outlet module;

[0014] FIGS. **4A-B** are exploded, front perspective views of outlet modules;

[0015] FIGS. **5A-B** are front and back perspective views, respectively, of an outlet module front cover;

[0016] FIGS. **6A-B** are front and back perspective views, respectively, of an outlet module back cover;

[0017] FIGS. **7A-B** are front and back perspective views, respectively, of an outlet module power contact set;

[0018] FIGS. **8A-B** are front and back perspective views, respectively, of an outlet module ground contact set;

[0019] **FIGS. 9-15** are perspective views of a switch module and switch module components;

[0020] FIGS. **9A-B** are front and back perspective views, respectively, of a switch module;

[0021] **FIG. 10** is an exploded, front perspective view of a switch module;

[0022] FIGS. **11A-B** are front and back perspective views, respectively, of a switch module switch;

[0023] FIGS. **12A-B** are front and back perspective views, respectively, of a switch module front cover;

[0024] FIGS. **13A-B** are front and back perspective views, respectively, of a switch module single-pole, single throw (SPST) contact set;

[0025] FIGS. **13C-D** are front and back perspective views, respectively, of a switch module single-pole, double throw (SPDT) contact set;

[0026] FIGS. **13E-F** are front and back perspective views, respectively, of a switch module double-pole, double throw (DPDT) contact set;

[0027] FIGS. **14A-B** are front and back perspective views, respectively, of a switch module actuator;

[0028] FIGS. **15A-B** are front and back perspective views, respectively, of a switch module back cover;

[0029] **FIGS. 16-22** are perspective views of a wiring module and wiring module components;

[0030] FIGS. **16A-B** are front and back perspective views, respectively, of a terminal-block wiring module;

[0031] FIGS. **16C-D** are back perspective views of a terminal-block wiring module and associated terminal guards in open positions;

[0032] FIGS. **16E-F** are front and back views, respectively, of a terminal-block wiring module and position-dependent wiring labels;

[0033] FIGS. **16G-H** are switch and outlet wiring schematics, respectively;

[0034] **FIG. 17A-B** are exploded, front perspective views of a terminal-block wiring module with stationary-mount and swivel-mount terminal guards, respectively;

[0035] FIGS. **18A-B** are front and back perspective views and a back view, respectively, of a wiring panel;

[0036] FIGS. **19A-B** are front and back perspective views, respectively, of a mounting bracket;

[0037] FIGS. **20A-B** are front and back perspective views, respectively, of a wiring panel front cover;

[0038] **FIG. 21** is a perspective view of a wiring panel terminal set;

[0039] FIGS. **22A-B** are front and back perspective views, respectively, of a wiring panel back cover;

[0040] FIGS. **23A-B** are front and back perspective views, respectively, of a dimmer switch module;

[0041] **FIG. 24** is an exploded, front perspective view of a dimmer switch module;

[0042] FIGS. **25A-B** are front and back perspective views, respectively, of a fixed-wire wiring module;

[0043] FIGS. **26A-B** are exploded, front and back perspective views, respectively, of a fixed-wire wiring module;

[0044] FIGS. **27A-B** are front and back perspective views, respectively, of an electrical box cover;

[0045] FIGS. **28A-B** are front perspective views of a covered and uncovered electrical box, respectively;

[0046] **FIG. 29** is a front perspective view of a 2-gang electrical box with overlapping covers;

[0047] FIGS. **30A-B** are back perspective and back perspective exploded views, respectively, of a wiring module having a terminal shield; and

[0048] FIGS. **31A-B** are front and back perspective views, respectively, of a terminal shield;

[0049] FIGS. **32A-B** are front and back perspective views, respectively, of a sealed wire wiring module; and

[0050] FIGS. **33A-B** are exploded front and back perspective views, respectively, of a sealed wire wiring module.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0051] System Overview

[0052] **FIGS. 1-2** illustrate a safety module electrical distribution system **100** having a functional module **110** and a wiring module **1600**. The electrical distribution system **100** is configured to mount within a standard electrical box (not shown), such as is typically installed within a building wall. In particular, the wiring module **1600** is configured to be easily installed within an electrical box, and a functional module **110** is configured to be removably plugged into the wiring module **1600**, as described below. FIGS. **1A-B** show

an outlet module **300** in an installed and a removed position, respectively. FIGS. **2**A-B show a switch module **900** in an installed and a removed position, respectively. A face plate (not shown) may be installed over a functional module **110** so as to provide an aesthetic trim.

[**0053**] As shown in **FIGS. 1-2**, each functional module **110** provides a user-accessible electrical distribution function. As shown in FIGS. 1A-B, the functional module **110** may be an outlet module **300**, which functions to supply a user with electrical power through a conventional AC plug inserted into one of the module sockets. The outlet module **300** is configured for installation in a ground-up position in a wiring module **1600** oriented for outlet installation. Alternatively, an outlet module and wiring module can be configured for outlet installation in a ground-down position.

[**0054**] As shown in FIGS. **2**A-B, the functional module **110** may be a switch module **900**, which allows a user to control electrical power to an outlet, a light or any of various electrical devices (not shown) by actuating the module switch. The switch is slideable between first and second positions in contrast to a conventional toggle switch, such as used for turning an interior light on and off. The switch module **900** is configured for installation in a wiring module **1600** oriented for switch installation. Reversible wiring module **1600** orientation within an electrical box to indicate the module to be installed and its proper orientation is described in detail with respect to FIGS. 16A-H, below

[**0055**] Other outlet and switch related functional modules **110** may include GFCI outlets, covered safety outlets and dimmer switches (**FIGS. 23-24**) to name just a few. Further, the electrical distribution system **100** may be wall-mounted, ceiling-mounted or floor-mounted. In additional, the electrical distribution system **100** can be adapted for uses other than building electrical distribution, such as airplane, automobile or boat electrical distribution applications, to name a few. A modular electrical outlet and switch system is described in U.S. Pat. No. 6,341,981 entitled Safety Electrical Outlet and Switch System, and a covered safety outlet module is described in U.S. patent application Ser. No. 10/737,713 entitled Safety Outlet Module, both assigned to ProtectConnect, Irvine, Calif. and incorporated by reference herein.

[**0056**] Outlet Module

[**0057**] FIGS. **3**A-B illustrate an outlet module **300** having a body **310**, a front side **301** and a back side **302**. The body **310** accepts attachment screws **305** on diagonally opposite comers that are utilized to secure the outlet module **300** to a wiring module **1600** (FIGS. 1A-B). The outlet module front side **301** provides upper and lower sockets **320** each configured to accept a conventional, three-wire (grounded) electrical plug. The outlet module back side **302** provides shielded plugs **330** and a ground bar **834** that physically and electrically connect the outlet module **300** to a wiring module **1600** (FIGS. 1A-B). The shielded plugs **330** transfer electrical power to the sockets **320**, and the ground bar **834** provides a ground path for the sockets **320**. The ground bar **834** also functions as a key to assist in orienting the outlet module **300** relative to the wiring module **1600** (FIGS. 1A-B).

[**0058**]. **FIG. 4A** illustrates an outlet module **300** having a front cover **500**, a rear cover **600**, a power contact set **700** and a ground contact set **800**. The front cover **500** and back cover **600** form the outlet module body **310** (FIGS. **3**A-B). The covers **500, 600** advantageously snap together with a latch and catch assembly, described with respect to **FIGS. 5-6**, below. This reduces manufacturing assembly steps and reduces or eliminates the need for separate fasteners, such as rivets or screws and/or sonic welding. The contact set **700, 800** is retained within the covers **500, 600** and provides conductive paths from the wiring panel **1600** (FIGS. 16A-B) to the outlet sockets **320 (FIG. 3A)**. In particular, a power contact set **700** transfers power from the shielded plugs **330 (FIG. 3B)** to the outlet sockets **320 (FIG. 3A)**. A ground contact set **800** provides a ground path between a ground bar **834 (FIG. 3B)** and the outlet sockets **320 (FIG. 3A)**. The ground contact set components **810, 830, 850** are assembled as described with respect to FIGS. **8**A-B, below. In one embodiment, the covers **500, 600** are constructed of nylon. **FIG. 4B** illustrates an alternative embodiment of an outlet module **400**, such as for **20**A applications

[**0059**] FIGS. **5**A-B illustrate the outlet module front cover **500** having an outside face **501**, an inside face **502**, outlet apertures **510**, attachment ears **520**, side latches **530** and contact housing structure **540, 550**. As shown in **FIG. 5A** on the outside face **501**, the outlet apertures **510** form the entry to the outlet module sockets **320 (FIG. 3A)** and include a hot slot, neutral slot and ground hole for each of a top socket and bottom socket. The attachment ears **520** are advantageously integral to the front cover **500**, eliminating the need for a separate mechanism for attaching the outlet module **300** (FIGS. 3A-B) to the wiring module **1600** (FIGS. 16A-B). The attachment ears **520** are located at an upper right corner and a diagonally opposite lower left corner (not visible), and each has a fastening aperture that accepts, for example, an attachment screw **305** (FIGS. 3A-B). The side latches **530** form the front cover portion of the latch and catch assembly, functionally described with respect to **FIG. 4**, above.

[**0060**] As shown in **FIG. 5B** on the inside face **502**, a power contact structure **540** accepts the power contact set **700** (FIGS. 7A-B) so that the power contact clips **701** (FIGS. 7A-B) align with the hot and neutral slots of the outlet apertures **510**. A ground contact structure **550** accepts the ground contact set **800** (FIGS. 8A-B) so that the ground contact clips **832, 852** (FIGS. 8A-B) align with the ground holes of the outlet apertures **510**.

[**0061**] FIGS. **6**A-B illustrate the outlet module back cover **600** having an outside face **601**, an inside face **602**, plug shields **610**, a ground bar aperture **620**, side catches **630** and contact support structure **640, 650**. As shown in **FIG. 6B** on the outside face **601**, the plug shields **610** advantageously provide the shield portion of the shielded plugs **330 (FIG. 3B)**. Specifically, the plug shields **610** completely surround all sides of the power contact set prongs **702** (FIGS. 7A-B). In this manner, the prongs **702** (FIGS. 7A-B) are not exposed when the outlet module plugs **330 (FIG. 3B)** are engaged with the wiring module sockets **810 (FIG. 18A)**, even when the outlet module **300** (FIGS. 3A-B) is partially separated from the wiring module **1600** (FIGS. 16A-B). The ground bar aperture **620** allows the ground bar **834** (FIGS. 8A-B) to protrude through the back cover **600**, providing a ground contact with the wiring module **1600** (FIGS. 16A-B). The side catches **630** provide apertures that accept and engage the side latches **530** (FIGS. 5A-B) so as to

releaseably secure together the front cover **500** (FIGS. 5A-B) and the back cover **600**.

[0062] As shown in **FIG. 6A** on the inside face **602**, a power contact support structure **640** consists of slots that allow the prongs **702** (FIGS. 7A-B) to protrude through the back cover **600** within the plug shields **610**, providing a power connection with the wiring module **1600** (FIGS. 16A-B). A ground contact support structure **650** supports the ground contact set **800** (FIGS. 8A-B).

[0063] FIGS. 7A-B illustrate the power contact set **700** having an upper hot contact **710**, a lower hot contact **720**, an upper neutral contact **730** and a lower neutral contact **740**. Each contact **710-740** has a prong clip **701** interconnected with a prong **702**. The prong clips **701** align with the front cover hot and neutral slots **510** (**FIG. 5A**) to form the outlet module sockets **320** (**FIG. 3A**). The prongs **702** insert through the power contact support structure **640** into the plug shields **610** to form the outlet module shielded plugs **330** (**FIG. 3B**). Advantageously, the power contact set **700** is configured so that the contacts may be manufactured by a stamp and fold process. In one embodiment, the contacts are brass.

[0064] FIGS. 8A-B illustrate a ground contact set **800** having a ground buss **810**, an upper ground contact **830** and a lower ground contact **850**. The ground clips **832, 852** align with the front cover ground holes **510** (**FIG. 5A**) to form the ground portion of the outlet module sockets **320** (**FIG. 3A**). The ground bar **834** protrudes through the back cover **600** (FIGS. 6A-B) to provide a ground path connection with the wiring module **1600** (FIGS. 16A-B). The unassembled ground contact set **800** is illustrated in **FIG. 4**, above. Ground contact set **800** assembly is described below.

[0065] As shown in FIGS. 8A-B, the ground buss **810** has a upper rivet **812**, a lower rivet **814**, a upper cutout **815**, a slot **816** and a lower cutout **818**. The ground buss **810** mechanically supports and electrically interconnects the upper ground contact **830** and the lower ground contact **850**. The upper ground contact **830** has an upper ground clip **832**, a ground bar **834**, leaves **836** and a tab **838**. The upper ground clip **832** and ground bar **834** extend from opposite ends of the upper ground contact **830**. The upper ground clip **832** accepts a ground pin from a standard AC electrical plug. The ground bar **834** inserts into a corresponding ground clip **1902** (FIGS. 19A-B) in the wiring module **1600** (FIGS. 16A-B). The tab **838** extends generally perpendicularly below and between the clip **832** and bar **834** and has an aperture corresponding to the top rivet **812**. The leaves **836** extend from the back of the clip **832**. The lower ground contact **850** has a lower ground clip **852**, leaves **854** and a tab **858**. The tab **858** extends generally perpendicularly to the clip **852** and has an aperture corresponding to the lower rivet **814**. The leaves **854** extend from the back of the clip **852**.

[0066] Also shown in FIGS. 8A-B, the ground contact set **800** is assembled by inserting the upper ground contact **830** and lower ground contact **850** into the ground buss **810**. Specifically, the ground bar **834** is inserted into the slot **816**, the leaves **836, 854** are inserted into the upper and lower cutouts **815, 818**, respectively, the upper and lower rivets **812, 814** are inserted through the tabs **838, 858**. The rivets **812, 814** are then splayed, fixedly attaching the upper and lower ground contacts **830, 850** to the ground buss **810**. Advantageously, the ground contact set **800** is configured so that the ground contact set components **810, 830, 850** may be manufactured by a stamp and fold process. In one embodiment, the upper and lower ground contacts **830, 850** are brass and the ground buss **810** is zinc-plated steel.

[0067] Switch Module

[0068] FIGS. 9A-B illustrate a switch module **900** having a body **910**, a front side **901** and a back side **902**. Like the outlet module body **310** (FIGS. 3A-B), the switch module body **910** accepts screws on diagonally opposite comers that are utilized to secure the switch module **900** to a wiring module **1600** (FIGS. 2A-B). The switch module front side **901** has a slideable switch **1100** configured to actuate internal contacts so as to route electrical power, to turn on and off a light, for example. Like the outlet module **300** (FIGS. 3A-B), the switch module back side **902** provides shielded plugs **930** that physically and electrically connect the switch module **900** to a wiring module **1600** (FIGS. 2A-B). The shielded plugs **930** conduct electrical power under control of the switch **1100**. There may be null plugs **940** having no conductors depending on the switch module **900** configuration and associated function, as described with respect to FIGS. 13A-F, below. The switch module **900** does not require a ground path to the wiring module **1600** (FIGS. 2A-B). A key bar **1520**, therefore, provides a non-conducting structure that substitutes for a ground bar **834** (**FIG. 3B**), to assist in orienting the switch module **900** relative to the wiring module **1600** (FIGS. 2A-B).

[0069] **FIG. 10** illustrates a switch module **900** having a switch **1100**, a front cover **1200**, a rear cover **1500**, a contact set **1300**, an actuator **1400** and a spring **1000**. The front cover **1200** and back cover **1500** form the switch module body **910** (FIGS. 9A-B). The covers **1200, 1500** advantageously snap together and are secured with a latch and catch assembly, described with respect to FIGS. 12A-B and 15A-B, below. This reduces manufacturing assembly steps and reduces or eliminates the need for separate fasteners, such as rivets or screws and/or sonic welding. In one embodiment, the covers **1200, 1500** are constructed of nylon.

[0070] As shown in **FIG. 10**, the switch **1100** snaps into and is slidably retained by the front cover **1200** and engages the actuator **1400**. The switch **1100** is movable between a first position and a second position. The contact set **1300**, actuator **1400** and spring **1000** are retained within the covers **1200, 1500**. The contact set **1300** routes electrical power from the wiring panel **1600** (FIGS. 1A-B) as determined by the switch **1100** positions. In particular, the position of the switch **1100** determines the position of the actuator **1400**, which, in turn, determines whether the contact set **1300** is open or closed. If closed, the contact set **1300** provides a conductive path that transfers power between the shielded plugs **930** (**FIG. 3B**). The switch **1100** remains in its manually set position under tension from the spring **1000**.

[0071] FIGS. 11A-B illustrate a switch **1100** that is generally rectangular, having a front side **1101** and a back side **1102**. The front side **1101** has a finger grip **1110** for manually sliding the switch between its first position and its second position, as described above. The back side **1102** has latches **1120** and a lever **1130** that extends in a direction generally normal to the plane of the back side **1102**. The latches **1120** are configured to pass through front cover slots **1214** (**FIG. 12A**), which cause the latches **1120** to flex inward toward the

extension **1130** as the switch **1100** is pressed into the front cover **1200** (FIGS. **12**A-B). The latches **1120** spring outward after the latches pass through the slots **1214** (**FIG. 12**A), seating the switch in the front cover **1200** (FIGS. **12**A-B), as described below. The lever tip **1132** inserts through the actuator slot **1410** (FIGS. **14**A-B) and contacts the spring **1000**, mechanically connecting the switch **1100** to the actuator **1400** (FIGS. **14**A-B).

[**0072**] FIGS. **12**A-B illustrate a front cover **1200** having an outside face **1201**, an inside face **1202**, a switch cavity **1210**, attachment ears **1220**, side latches **1230** and top and bottom catches **1240**. Located on the outside face **1201**, the cavity **1210** is configured to accommodate the switch **1100** (FIGS. **1**A-B). Within the cavity **1210** is a lever slot **1212** that allows the switch lever **1130** (**FIG. 11B**) to pass through the front cover to the actuator **1400** (FIGS. **14**A-B). The lever slot **1212** extends along the cavity **1210** a sufficient distance to allow switch movement between first and second positions, as described above. Also within the cavity **1210** are catch slots **1214** that accommodate and capture the switch latches **1120** (**FIG. 11B**), as described above. The attachment ears **1220** are located at an upper right corner and a diagonally opposite lower left corner (not visible), and each has a fastening aperture that accepts, for example, an attachment screw **305** (FIGS. **3**A-B). The side latches **1230** and top and bottom catches **1240** form the front cover portion of the latch and catch assembly, functionally described with respect to **FIG. 10**, above.

[**0073**] FIGS. **13**A-B illustrate a SPST contact set **1300** having a throw buss **1310** and a pole buss **1320**. The throw buss **1310** has a first prong **1312**, a flexible throw **1314** and a throw contact **1318**. The pole buss **1320** has a second prong **1322**, a fixed pole **1324** and a pole contact **1328**. The first and second prongs **1312**, **1322** form the conductive portion of the shielded plugs **930** (**FIG. 9B**). The flexible throw **1314** engages the actuator **1400**, as described with respect to FIGS. **14**A-B, below, which moves the throw between an open position and a closed position (shown). In the closed position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. In the open position, the throw contact **1318** is separated from the pole contact **1328** so that there is no conductive path between the first and second prongs **1312**, **1322**.

[**0074**] FIGS. **13**C-D illustrate a SPDT contact set **1301** for a 3-way switch having a second pole buss **1330** in addition to the SPST contact set **1300** (FIGS. **13**A-B). The second pole buss **1330** has a third prong **1332** and a second pole contact **1338**. The flexible throw **1314** engages the actuator **1400**, as described with respect to FIGS. **14**A-B, below, which moves the throw between a first position (shown) and a second position. In a first position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. In a second position, the throw contact **1318** touches and electrically connects with the second pole contact **1338**, establishing a conductive path between the first and third prongs **1312**, **1332**.

[**0075**] FIGS. **13**E-F illustrate a DPDT contact set **1302** for a 4-way switch having a second throw buss **1340** and a third pole buss **1350** in addition to the SPDT contact set **1301**. The second throw buss **1340** has a second flexible throw **1344**. The second throw buss **1340** has a fourth prong **1342**, a second flexible throw **1344** and a second throw contact **1348**. The second pole buss **1330** has the third pole contact **1339**, and the third pole buss **1350** has a fourth pole contact **1359**. In a first position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. Also, the second throw contact **1348** touches and electrically connects with the third pole contact **1339**, establishing a conductive path between the third and fourth prongs **1332**, **1342**. In a second position, the throw contact **1318** touches and electrically connects with the second pole contact **1338**, establishing a conductive path between the first and third prongs **1312**, **1332**. Also, the second throw contact **1348** touches and electrically connects with the fourth pole contact **1339**, establishing a conductive path between the second and fourth prongs **1322**, **1342**.

[**0076**] FIGS. **14**A-B illustrate an actuator **1400** having a front face **1401**, a back face **1402** and a lever slot **1410** generally centered within and passing through the front and back faces **1401**, **1402**. The actuator **1400** is positioned within the switch module **900** (**FIG. 10**) so that the front face **1401** is proximate the front cover **1200** (**FIG. 10**) and the contact set **1300** (**FIG. 10**) and the back face **1402** is proximate the spring **1000** (**FIG. 10**) and the back cover **1500** (**FIG. 10**). The lever slot **1410** accommodates the switch lever tip **1132** (**FIG. 11B**), as described above. The front face **1401** has a pair of upper arms **1420** and a pair of lower arms **1430** extending generally perpendicularly from the front face **1401** so as to engage the contact set **1300** (FIGS. **13**A-B). In particular, the flexible throw **1314** (FIGS. **13**A-B) is engaged between the upper arms **1420**. For a DPDT contact set **1302** (FIGS. **13**E-F), a second flexible throw **1344** (FIGS. **13**E-F) is engaged between the lower arms **1430**. The back face **1402** has a pair of posts **1440** that are slidably retained within back cover guides **1550** (**FIG. 15A**).

[**0077**] FIGS. **15**A-B illustrate a rear cover **1500** having an inside face **1502**, an outside face **1501**, plug shields **1510**, a key bar **1520**, side catches **1530**, top and bottom latches **1540**, actuator guides **1550**, a spring hold **1560** and contact support structure **1570**. As shown in **FIG. 15B** on the outside face **1501**, the plug shields **1510** advantageously provide the shield portion of the shielded plugs **930** (**FIG. 9B**). Specifically, the plug shields **1510** completely surround all sides of the contact set prongs **1312**, **1322** (FIGS. **13**A-B). In this manner, the prongs are not exposed when the switch module plugs **930** (**FIG. 9B**) are engaged with the wiring module sockets **1810** (**FIG. 18A**), even when the switch module **900** (FIGS. **9**A-B) is partially separated from the wiring module **1600** (FIGS. **16**A-B). The key bar **1520** is configured to insert into the wiring module ground socket **1820** (**FIG. 18A**), although the key bar **1520** is nonconductive. The key bar **1520** assists proper orientation of the switch module **900** (FIGS. **9**A-B) to the wiring module **1600** (FIGS. **16**A-B). The side catches **1530** provide apertures that accept and engage the side latches **1230** (FIGS. **12**A-B), and the top and bottom latches **1540** insert into and engage the top and bottom catches **1240** (FIGS. **12**A-B) so as to releaseably secure together the front cover **1200** (FIGS. **12**A-B) and the back cover **1500**.

[0078] As shown in **FIG. 15A** on the inside face **1502**, the actuator guides **1550** slidably retain the actuator posts **1440** (**FIG. 14B**). The spring hold **1560** accommodates and retains the spring **1000** (**FIG. 10**). The contact support structure **1570** consists of slots through the back cover **1500** and structure extending generally normal to the inside face **1502** that support the contact set **1300** (FIGS. 13A-B). The slots accept the contact set prongs **1312**, **1322** (FIGS. 13A-B), which protrude through the back cover **1500** within the plug shields **1510**.

[0079] Terminal-Block Wiring Module

[0080] FIGS. **16A-B** illustrate a terminal-block wiring module **1600** having a functional side **1601** and a wiring side **1602**. The functional side **1601** has structured sockets **1810** and an off-center ground socket **1820**. The structured sockets **1810** accept corresponding functional module shielded plugs, as described with respect to **FIG. 20A**, below. The wiring module **1600** is configured to mount within a conventional electrical box (not shown), secured with attachment screws **1605**. A functional module, such as an outlet module **300** (FIGS. 3A-B) or a switch module **900** (FIGS. 9A-B) plug into the wiring module functional side **1601**, secured to the wiring module with attachment screws that thread through attachment ears and corresponding module mounts **1930**, as described with respect to **FIGS. 1-2**, above. A power cable (not shown) routed into the electrical box attaches to a terminal block **1640** (**FIG. 16F**) accessible from the wiring module wiring side **1602**, as described with respect to FIGS. 16E-H, below.

[0081] As shown in FIGS. **16A-B**, a wiring module **1600** advantageously can be installed, wired and tested by journeyman electrician at the rough-in phase of building construction. The wiring module **1600** is mounted within an electrical box according to the type of functional module for which the wiring module **1600** will be wired. If the wiring module **1600** is mounted in a first orientation (**FIG. 1B**), the ground socket **1820** is positioned below-center. If the wiring module is mounted in a second orientation (**FIGS. 2B, 16A**), the ground socket **1820** is positioned above-center. The ground socket **1820** accepts an outlet module ground bar **834** (**FIG. 3B**) or switch module key bar **1520** (**FIG. 9B**), which act as keys. Correspondingly, the ground socket **1820** acts as a block that accepts a functional module key **834** (**FIG. 3B**), **1520** (**FIG. 9B**) only when the functional module is properly oriented with respect to the wiring module **1600** according to module type, such as a switch or outlet. In one embodiment, the wiring module **1600** is mounted with the ground socket **1820** above-center for a switch module **900** (FIGS. 9A-B) and mounted with the ground socket **1820** below-center for an outlet module **300** (FIGS. 3A-B), as described in further detail with respect to FIGS. 16E-H, below.

[0082] FIGS. 16C-D illustrate a terminal-block wiring module **1600** having terminal guards **1700** that advantageously provide covered access to the terminal set **2100** (**FIG. 21**). In particular, in a closed position (FIGS. **16A-B**) the terminal guards **1700** protect users from shock and insulate between closely mounted high voltage devices. In an open position (FIGS. 16C-D), the terminal guards **1700** allow convenient access to the terminal screws **2140** so as to attach or remove power cable wires from the terminal blocks **1640**. As shown in **FIG. 16C**, a hinge **1702** allows a terminal guard **1700** to move from a closed position FIGS. (16A-B) to an open position. A latch **1704** presses into a corresponding catch slot **2220**, which retains a terminal guard **1700** in a closed position until it is manually opened. As shown in **FIG. 16D**, in one embodiment a swivel mount **1709** (**FIG. 17B**) also allows the terminal guard **1700** to swivel from side to side in an open position, further easing access to the terminal screws **2140**.

[0083] FIGS. 16E-F illustrate orientation-dependent labels on the wiring module functional and wiring sides, respectively. As described above, the type of functional module to be mounted in the wiring module **1600** determines the mounted orientation of the wiring module **1600** within an electrical box. Color coded labels **1620**, **1630** on the functional side (**FIG. 16E**) and wiring labels **1650**, **1660** on the wiring side (**FIG. 16F**) advantageously indicate to the journeyman electrician the correct wiring module **1600** orientation. The color coded labels **1620**, **1630** also advantageously indicate the correct functional module to be installed or replaced. In particular, as shown in **FIG. 16E**, the color coded labels include a switch label **1620** and an outlet label **1630**. The switch label **1620** has an orientation indicator **1622** and corresponding text that specify the wiring module orientation for a switch module **900** (FIGS. 2A-B). In addition, color boxes **1624** advantageously match color indicators **2310** (**FIG. 23A**) on corresponding switch modules **900**. Further, as shown in **FIG. 16F**, the outlet label **1630** has an orientation indicator **1632** and corresponding text that specify the wiring module orientation for an outlet module **300** (FIGS. 1A-B). Also, color boxes **1634** match an outlet color indicator. In one embodiment, the switch color boxes **1624** are yellow, red and orange matching SP, 3-way and 4-way switch color indicators, respectively. The outlet color boxes **1634** are dark and light blue for full hot and half-hot wiring, matching a blue color indicator for an outlet module. The color boxes **1624**, **1634** are marked by the journeyman electrician at wiring module installation to visually indicate the module type for which the wiring module **1600** was wired.

[0084] As shown in **FIG. 16F**, there are four terminal blocks **1640**, each having terminal labels "1,""2,""3" and "4"**1670** identifying the individual terminal blocks **T1**, **T2**, T3 and T4 by number. In a switch orientation (shown), switch labels **1650** are advantageously positioned in a manner visually corresponding to each of the individual terminal blocks **1640**. The switch labels **1650** identify switch wiring for each terminal block by switch type SP, 3-way and 4-way. The outlet labels **1660** are upside down in the switch orientation, visually indicating that they are inapplicable. In an outlet orientation (upside down from that shown), outlet labels **1660** are similarly positioned in a manner visually corresponding to each of the individual terminal blocks **1640**. The outlet labels **1660** identify outlet wiring. The switch labels **1650** are upside down in the outlet orientation, visually indicating that they are inapplicable.

[0085] FIGS. 16G-H illustrate switch and outlet wiring schematics, respectively, corresponding to the terminal labels **1670** (**FIG. 16F**), switch labels **1650** (**FIG. 16F**) and outlet labels **1660** (**FIG. 16F**) described with respect to **FIG. 16F**, above. Graphically depicted are groups of four terminals **1690** representing the terminal blocks **1640** (**FIG. 16F**). Also depicted are individual terminal blocks **1691**, corre-

sponding hot, neutral, traveler and switch wires **1692**, and links and gaps **1693** corresponding to removable breakaways **2116**.

[**0086**] FIGS. **17A-B** illustrate a terminal-block wiring module **1600** having a wiring panel **1800** and a mounting bracket **1900**. The wiring panel **1800** has a front cover **2000**, a back cover **2200**, a terminal set **2100** and terminal guards **1700**. The front cover **2000** and back cover **2200** are secured together with a fastener (not shown). The mounting bracket **1900** further secures the front cover **2000** to the back cover, as described with respect to **FIGS. 18-20**, below. The terminal set **2100** is retained within the wiring panel **1800** and provides terminal blocks **1640** (**FIG. 16F**) for power cable attachment and provides conductive paths between the terminal blocks **1640** (**FIG. 16F**) and structured sockets **1810** (**FIG. 18A**). The mounting bracket **1900** advantageously performs multiple functions including securing the wiring module **1600** to an electrical box (not shown), securing together the front and back covers **2000**, **2200**, providing a ground bar clip **1902** (**FIG. 19A**) for contact with a module ground bar **834** (**FIG. 3B**) and providing a ground terminal **1907** (**FIG. 19A**) for a ground wire connection.

[**0087**] As shown in FIGS. **17A-B**, the terminal guards **1700** each have a hinge **1702**, a latch **1704**, a mount **1706**, **1709** and a grip **1708**. The mount **1706**, **1709** slides into a corresponding guard slot **2210** (**FIG. 22A**) on each side of the back cover **2200**, which secures each terminal guard **1700** to the wiring panel **1800**. The hinge **1702** advantageously allows a terminal guard **1700** to move between a closed position (FIGS. **16A-B**) blocking inadvertent contact with the terminal blocks **1640** (**FIG. 16F**) and an open position (FIGS. **16C-D**) allowing access to the terminal blocks **1640** (**FIG. 16F**). The latch **1704** presses into a corresponding catch slot **2220** (**FIG. 22A**) on each side of the back cover **2200**, which retains each terminal guard **1700** in a closed position until it is manually opened. A grip **1708** assists in latching the terminal guards **1700**. A stationary mount **1706** (**FIG. 17A**) holds the terminal guards **1700** in alignment with the terminal screws **2140** (**FIG. 21**). Alternatively, a swivel mount **1709** (**FIG. 17B**) advantageously allows the terminal guards **1700** to swivel to either side **1601**, **1602** (FIGS. **16A-B**) of the wiring module for easier access to the terminal screws **2140** (**FIG. 21**).

[**0088**] FIGS. **18A-B** illustrate a wiring panel **1800** having a front side **1801** and a back side **1802**. The front side **1801** has structured sockets **1810**, a ground socket **1820** and bracket slots **1830**. The back side **1802** has terminal blocks **1640** (**FIG. 16F**) formed by a terminal set **2100** (**FIG. 21**) having terminal screws **2140** (**FIG. 21**) that are accessed through the terminal guards **1700**, as described above.

[**0089**] FIGS. **19A-B** illustrate a mounting bracket **1900** having a bracket body **1901**, a ground clip **1902** and a ground terminal **1907**. The ground clip **1902** is attached to the bracket body **1901** with a rivet **1905**. The ground terminal **1907** provides a ground termination for a ground wire (not shown). The bracket **1900** has swages **1910**, box mounts **1920** and module mounts **1930**. The bracket **1900** is configured to be disposed around the rear cover **2200** (FIGS. **22A-B**) with the swages **1910** inserted through front cover slots **2020** (FIGS. **20A-B**) and spread against the front cover outside **2001** so as to secure together the front and rear covers **2000**, **2200**. A fastener **1909** is inserted through the bracket and into the wiring panel front cover **2000**, so as to secure together the front and rear covers **2000**, **2200**. The box mounts **1920** allow the wiring module **1600** (FIGS. **16A-B**) to be secured to an electrical box (not shown) and are configured to removably engage a box cover (**FIGS. 27-29**). The module mounts **1930** allow functional modules **300** (FIGS. **3A-B**), **900** (FIGS. **9A-B**) to be secured to the wiring module **1600** (FIGS. **16A-B**). The ground clip **1902** is configured to physically and electrically connect to a module ground bar **834** (FIGS. **8A-B**).

[**0090**] In an alternative embodiment, the mounting bracket **1900** does not have swages **1910**. Multiple fasteners **1909** are inserted through the mounting bracket **1900** and into the wiring panel front cover **2000**, so as to secure together the front and rear covers **2000**, **2200**. After the mounting bracket **1900** is attached to the front cover **2000**, ears at the top and bottom of the mounting bracket **1900** are bent over and against the front cover outside **2001** to further secure together the front and rear covers **2000**, **2200**. Trusses are included across or proximate to folded portions of the mounting bracket **1900** to strengthen the bracket structure. The box mount **1920** may have an alternative shape so as to accommodate a box cover **2700** (FIGS. **27A-B**).

[**0091**] FIGS. **20A-B** illustrate a front cover **2000** having an outside face **2001** and an inside face **2002**. As shown in **FIG. 20A** on the outside face **2001**, raised guards **2010** and surrounding channels **2014** provide the nonconductive portions of structured sockets **1810** (**FIG. 18A**). Each raised guard **2010** and surrounding channel **2014** are configured to mate with a corresponding plug shield **610** (**FIG. 6B**). In particular, when a functional module is plugged into the wiring module **1600** (FIGS. **16A-B**), shields **610** (**FIG. 6B**), **1510** (**FIG. 15B**) insert into channels **2014**, guards **2010** insert within shields **610** (**FIG. 6B**), **1510** (**FIG. 15B**), and prongs **702** (FIGS. **7A-B**) plug into power clips **2112** (**FIG. 21**). This interlocking action of the shield plugs **330** (**FIG. 3B**), **930** (**FIG. 9B**) and the structured sockets **1810** (**FIG. 18A**) advantageously provides a fully enclosed shield as an electrical connection is made between a functional module and a wiring module, in addition to tactile feedback and a solid mechanical and electrical connection. Further, the guards **2010** and channels **2014** reduce the chance of an inadvertent contact between a tool, such as a screwdriver tip, and a hot contact within a socket **1810** (**FIG. 18A**). For example, a tool dragged across the wiring panel front side **1801** (**FIG. 18A**) during service will tend to lodge in the channel **2014** or against the raised guard **2010** or both. In a particular embodiment, the shields **610** (**FIG. 6B**), **1510** (**FIG. 15B**) and the corresponding channels **2014** and raised guards **2010** are generally rectangular in shape with rounded comers.

[**0092**] As shown in **FIG. 20B**, the inside face **2002** has swage slots **2020**, a ground aperture **2030** and terminal support structure **2050**, **2060**. The swage slots **2020** accommodate the mounting bracket swages **1910** (**FIG. 19A**), which assist to secure together the front and back covers **2000**, **2200**. The ground aperture **2030** accommodates a ground bar **834** (**FIG. 3B**) or key bar **1520** (**FIG. 9B**) as part of a ground socket **1820** (**FIG. 18A**). The support structure **2050**, **2060** houses the terminal set **2100** (**FIG. 21**).

[**0093**] **FIG. 21** illustrates a terminal set **2100** having contact busses **2110**, terminal clamps **2130** and terminal

screws **2140**. The contact busses **2110** each have power clips **2112** that provide the conductor portion of the structured sockets **1810** (**FIG. 18A**). The power clips **2112** are configured to physically and electrically connect with module prongs **702** (FIGS. 7A-B), **1312**, **1322** (FIGS. 13A-B). The terminal clamps **2130** and terminal screws **2140** terminate power cables (not shown) to the contact busses **2110**. The terminal clamps **2130** are configured to secure one wire per channel **2132**. Advantageously, this provides a four-wire capacity for each of four terminal blocks **1640** (**FIG. 16F**). In one embodiment, each terminal block **1640** (**FIG. 16F**) is configured for four 14 gauge copper wires or two 12 gauge copper wires. Breakaways **2116** are removable to selectively isolate individual terminal blocks **1640** (**FIG. 16F**).

[**0094**] FIGS. **22**A-B illustrate a back cover **2200** having an inside face **2202** and an outside face **2201**. The inside face **2202** has mount slots **2210** and catch slots **2220** that retain the terminal guards **1700** (**FIG. 17**), as described above. The inside face **2202** also has terminal slots **2230** that retain the terminal set. The outside face **2201** is shaped to accommodate the mounting bracket **1900** (FIGS. 19A-B) and accommodate power cable attachment to the terminal blocks **1640** (**FIG. 16F**).

[**0095**] Dimmer Switch Module

[**0096**] FIGS. **23**A-B illustrate a dimmer switch module **2300** having a switch **2410** and a dimmer lever **2460** on a front side **2301** and shielded plugs **2330** and a key bar **2350** on a back side **2302**. The top of the switch module **2300** also has a color label **2310**. The color label **2310** corresponds in color to one of the wiring module color labels **1624**. In this manner, the switch module color label **2310** advantageously provides a visual indication of proper module orientation and avoids installation into a wiring module **1600** (**FIG. 16E-F**) wired for a different module type. Similar color labels of differing colors may be applied in a similar fashion to outlet modules **300** (FIGS. 3A-B) and other switch modules **900** (FIGS. 9A-B) for the same purpose. **FIG. 24** illustrates the dimmer switch module **2300** including a switch **2410**, a front cover **2420**, a bracket **2430**, a circuit board **2440**, a back cover **2450** and a dimmer lever **2460**.

[**0097**] Fixed-Wire Wiring Module

[**0098**] FIGS. **25**A-B illustrate a fixed-wire wiring module **2500** having a functional side **2501** and a wiring side **2502**. The wiring module **2500** is configured to mount within a conventional electrical box (not shown), secured with attachment screws (not shown) threaded through box mounts **2652**. A functional module, such as an outlet module **300** (FIGS. 3A-B) or a switch module **900** (FIGS. 9A-B) plug into the wiring module functional side **2501**, secured to the wiring module **2500** with attachment screws (not shown) that thread through attachment ears (not shown) and corresponding module mounts **2654**, as described with respect to **FIGS. 1-2**, above. A power cable (not shown) routed to the electrical box attaches to pushwire connectors **2570** at the end of fixed wires **2550** extending from the wiring module wiring side **2502**.

[**0099**] FIGS. **26**A-B illustrate a fixed-wire wiring module **2500** having a front cover **2610**, a back cover **2620**, a terminal set **2630**, a mounting bracket **2650**, a ground bar clip **2660** and fasteners **2670**. The front cover **2610** and back cover **2620** are secured together with the fasteners **2670** and enclose the terminal set **2632**. Advantageously, the mounting bracket **2650** is partially enclosed by, and retained between, the front cover **2610** and back cover **2620** so as to secure the mounting bracket **2650** to, and mechanically and electrically integrate the mounting bracket with, the wiring module **2500**.

[**0100**] As shown in FIGS. **26**A-B the front cover **2610** has structured sockets **2612**, a ground aperture **2614**, support structure **2616** and fastener posts **2618**. The structured sockets **2612** interlock with functional module shielded plugs and the ground aperture **2614** accommodates a ground bar or key bar as part of a ground socket in a manner as described with respect to FIGS. **20**A-B, above. The support structure **2616** houses the terminal set **2630**. The fastener posts **2618** align with fastener apertures **2624** and accept the fasteners **2670** securing the front cover **2610** to the back cover **2620**.

[**0101**] Also shown in FIGS. **26**A-B, the terminal set **2630** has power clips **2632**, fixed wire terminals **2634** and breakaways **2638**. The power clips **2632** provide the conductor portion of the structured sockets **2612** and are configured to physically and electrically connect with module prongs in a manner as described with respect to **FIG. 21**, above. The fixed wire terminals **2634** electrically and mechanically connect a stripped end of the fixed wires **2550** (FIGS. **25**A-B) to the terminal set **2630**. The breakaways **2638** are removable to selectively isolate individual power clips **2632**.

[**0102**] Further shown in FIGS. **26**A-B, the mounting bracket **2650** is adapted to a channel extending lengthwise along the front cover **2610** and corresponding support structure extending lengthwise along the back cover **2620**. The mounting bracket **2650** has box mounts **2652**, module mounts **2654**, a ground clip aperture **2656** and a ground terminal **2658**. The box mounts **2652** accept fasteners (not shown) to secure the bracket to an electrical box (not shown). The module mounts **2654** accept fasteners (not shown) to secure a functional module (not shown) to the wiring module **2500**. The ground clip aperture **2656** is adapted to the ground clip **2660**, which connects a functional module ground bar electrically and mechanically to the bracket **2650**. The bracket has an integrated rivet for securing the ground clip **2660** within the aperture **2656**. The ground terminal **2658** electrically and mechanically connects a stripped end of a ground one of the fixed wires **2550** (FIGS. **25**A-B) to the bracket **2650**.

[**0103**] Additionally shown in FIGS. **26**A-B, the back cover **2620** has wire apertures **2622**, fastener apertures **2624** and a breakaway aperture **2626**. The wire apertures **2622** are adapted to the fixed wires **2550** (FIGS. **25**A-B) so as to provide a seal around and strain relief for the fixed wires and access to the terminal set **2630** and ground terminal **2658**. The fastener apertures **2624** accept that portion of the fasteners **2670** that thread into or are otherwise secured to the fastener posts **2618**. The breakaway aperture **2626** allows user access to the breakaways **2638** within an assembled wiring module **2500**.

[**0104**] Electrical Box Cover

[**0105**] FIGS. **27**A-B illustrate an electrical box cover **2700** having a generally planar cover plate **2710**, clamps **2720**, catches **2730**, trusses **2740** and markers **2750**. The cover plate **2710** has a front side **2701** and a back side **2702**.

The clamps **2720** are located, one each, generally centered on the top and bottom of the cover plate **2710** and extend generally perpendicularly from the back side **2702**. The catches **2730** are apertures, one for each catch **2730**, that are generally centered on the catches **2720** and extending along the juncture between the catches **2730** and the cover plate **2710**. The trusses **2740** are protrusions on the cover plate **2740** that extend substantially along the length of the front side **2701**, providing structural support to resist bending of the cover plate **2710**. The markers **2750** are generally round protrusions on the front side **2701** of the cover plate **2740** located, one each, proximate the top and bottom of the cover plate **2740**.

[0106] FIGS. **28**A-B illustrate an electrical box **2800** that is covered and uncovered, respectively, by a box cover **2700**, as described with respect to FIGS. **27**A-B, above. The box cover **2700** removably mounts over the electrical box open face **2801** so as to prevent material such as plaster and paint from fouling the wiring module **1600** during the makeup phase of construction. Advantageously, the box cover **2700** mounts generally flush with the electrical box open face **2801** and, hence, generally flush with installed drywall so as not to interfere with drywall construction during the makeup phase. Drywall, once loosely positioned, can be pressed against the box cover **2700**. In doing so, the markers **2750** dimple the drywall, advantageously marking the location of the electrical box **2800** so that drywall cutouts can be accurately made to accommodate the electrical box **2800**.

[0107] As shown in FIGS. **28**A-B, the box cover **2700** is installed on the box mounts **1920** of a wiring module **1600** mounted within the electrical box **2800**. In particular, the clamps **2720** flex somewhat to slide over the box mounts **1920** until the box mounts **1920** insert into corresponding catches **2730**. The box cover **2700** can be easily removed by flexing the clamps **2720** so that a box mount **1920** clears a corresponding catch **2730**.

[0108] **FIG. 29** illustrate a 2-gang electrical box **2900** with overlapping box covers **2700**. The box covers **2700** are configured so that a first portion **2791** of one cover overlaps a second portion **2792** of another cover so as to prevent drywall related material from entering between the covers **2700** and fouling the electrical box **2900** interior.

[0109] Terminal Shield

[0110] FIGS. **30**A-B illustrate a terminal-block wiring module **1600** having a terminal shield **3100** installed on a wiring side **1602** using fasteners **1909**. The terminal shield **3100** advantageously prevents bare copper ground wires (not shown), which typically are connected between the ground terminal **1907** (**FIG. 17A**) and an electrical box (not shown), from inadvertently protruding through the back cover **2200** (**FIG. 17A**) and short circuiting the terminal set **2100** (**FIG. 17A**).

[0111] FIGS. **31**A-B illustrate a terminal shield **3100** having a front side **3101**, a back side **3102** and a spine **3105**. Mounting ears **3110** extend from both ends of the spine **3105**, and shield wings **3120** extend from both sides of the spine **3105**. Breakaway guards **3130** extend from a central portion of each shield wing **3120**. A V-shaped hinge **3135** extending across a portion of each breakaway guard **3130** allows the breakaway guards **3130** to flex somewhat to gain access for removal of one or both of the breakaways **2116** (**FIG. 16F**), as described with respect to FIGS. **16**G-H, above. Mounting apertures **3140** are defined in the mounting ears **3110**, wire apertures **3150** are defined in the shield wings **3120**, and a bracket aperture **3160** is defined in a central portion of the spine **3105**.

[0112] As shown in FIGS. **31**A-B, the terminal shield **3100** is installed with the back side **3102** proximate the wiring module **1600** (**FIG. 30A**) and the front side **3101** distal the wiring module **1600** (**FIG. 30A**). In particular, the spine **3105** fits against the bracket **1900** and the bracket aperture **3160** accommodates protrusions due to the ground clip **1902** (**FIG. 17A**) or its associated fastener. The mounting apertures **3140** accept the fasteners **1909** (**FIG. 30A**), which also secure together the wiring module **1600** (**FIG. 30A**). The shield wings **3120** cover exposed portions of the terminal set **2100** (**FIG. 17A**), and the wire apertures **3150** accommodate wire ends that are connected to the terminal set **2100** (**FIG. 17A**).

[0113] Other Functional Modules

[0114] Although described above with respect to outlet and switch modules, the electrical distribution system may operate in conjunction with a variety of functional modules providing various electrical functions, such as security modules, data transfer modules, computing modules, home entertainment modules and intelligent home product modules to name a few. For example, a security module may incorporate a video camera or motion sensor. A data transfer module may incorporate data storage devices, wireless transceivers or AC power line transceivers. A computing module may incorporate a microprocessor, a data entry or display device, for example. A home entertainment module may work in conjunction with speakers, LCD panels or plasma TVs. A home product module, for instance, may incorporate a microcontroller and a wireless or an AC power line transceiver for appliance control.

[0115] Sealed Wiring Modules

[0116] FIGS. **32**A-B illustrate a sealed wire wiring module **3200** having a functional side **3201** and a wiring side **3202**. Advantageously, a shield **3360** is disposed proximate the wiring side **3202** and configured to seal the wiring module **3200** so as to protect electricians and users alike from inadvertent exposure to potentially hazardous electrical power. As shown in FIGS. **32**A-B, the wiring module **3200** is mounted within a conventional electrical box (not shown) and secured with attachment screws (not shown) threaded through box mounts **3342**. A functional module, such as an outlet module or a switch module plug into the wiring module functional side **3201**, secured to the wiring module **3200** with attachment screws (not shown) that thread through attachment ears (not shown) and corresponding module mounts **3344**. A power cable (not shown) routed to the electrical box attaches to push wire connectors **3270** at the end of fixed wires **3250** extending from the wiring module wiring side **3202**.

[0117] FIGS. **33**A-B illustrate a sealed wiring module **3200** having a front cover **3310**, a centered open back cover **3320**, a terminal set **3330**, a mounting bracket **3340**, a ground bar clip **3350**, a shield **3360** and fasteners **3370**. The front cover **3310** and back cover **3320** are secured together with the fasteners **3370** and enclose the terminal set **3330**. The mounting bracket **3340** is partially enclosed by, and

retained between, the front cover **3310** and back cover **3320** so as to secure the mounting bracket **3340** to, and mechanically and electrically integrate the mounting bracket **3340** with, the wiring module **3200**.

[0118] As shown in FIGS. **33**A-B, the front cover **3310** has structured sockets **3312**, a ground aperture **3314**, support structure **3316** and fastener posts **3318**. The structured sockets **3312** interlock with functional module shielded plugs, and the ground aperture **3314** accommodates a ground bar or key bar. The support structure **3316** houses the terminal set **3330**. The fastener posts **3318** align with fastener apertures **3324** and accept the fasteners **3370** securing the front cover **3310** to the back cover **3320**.

[0119] Also shown in FIGS. **33**A-B, the terminal set **3330** has power clips **3332**, fixed wire terminals **3334** and breakaways **3338**. The power clips **3332** provide the conductor portion of the structured sockets **3312** and are configured to physically and electrically connect with functional module prongs. The fixed wire terminals **3334** electrically and mechanically connect stripped ends of the fixed wires **3250** to the terminal set **3330**. The fixed wires **3250** are adapted to transfer electrical power from the power cable to the terminal set **3330** and, hence, to the structured sockets **3312**. The breakaways **3338** are removable to selectively isolate individual power clips **3332**.

[0120] Further shown in FIGS. **33**A-B, the mounting bracket **3340** is housed in a channel extending lengthwise along the front cover **3310** and corresponding support structure extending lengthwise along the back cover **3320**. The mounting bracket **3340** has box mounts **3342**, module mounts **3344**, a ground clip aperture **3346** and a ground terminal **3348**. The box mounts **3342** accept fasteners (not shown) to secure the bracket to an electrical box (not shown). The module mounts **3344** accept fasteners (not shown) to secure a functional module (not shown) to the wiring module **3200**. The ground clip aperture **3346** is adapted to the ground clip **3350**, which connects a functional module ground bar electrically and mechanically to the bracket **3340**. The bracket has an integrated rivet for securing the ground clip **3350** within the aperture **3346**. The ground terminal **3348** electrically and mechanically connects a stripped end of a ground one of the fixed wires **3250** to the bracket **3340**.

[0121] Additionally shown in FIGS. **33**A-B, the back cover **3320** has wire apertures **3322**, fastener apertures **3324** and breakaway apertures **3326**. The wire apertures **3322** are adapted to the fixed wires **3250** so as to provide a seal around and strain relief for the fixed wires and access to the terminal set **3330** and ground terminal **3348**. The fastener apertures **3324** accept those portions of the fasteners **3370** that thread into or are otherwise secured to the fastener posts **3318**. The breakaway apertures **3326** allow access to the breakaways **3338** within an assembled wiring module **3200**.

[0122] Further shown in FIGS. **33**A-B, the shield **3360** is attached to the back cover **3320** so as to enclose the breakway aperture **3326**. That is, the back cover **3320** and shield **3360** combined completely enclose the terminal set **3330** at the wiring side **3202** (**FIG. 32B**) so that there are no exposed power conductors. The shield **3360** has a mounting wall **3362** and knockouts **3364**. The mounting wall **3362** is disposed proximate the center of the shield **3360** and has extensions connecting both of the knockouts **3364**. The knockouts **3364** extend generally perpendicularly from the mounting wall extensions. The mounting wall **3362** has a mounting hole **3366** accommodating a fastener **3380** so that the shield **3360** fixedly attaches to the back cover **3320**. The knockouts **3364** are individually removable to provide access to the breakways **3338**.

[0123] An electrical distribution wiring module has been disclosed in detail in connection with various embodiments. These embodiments are disclosed by way of examples only and are not to limit the scope of the claims that follow. One of ordinary skill in the art will appreciate many variations and modifications.

What is claimed is:

1. A wiring module adapted to mount within an electrical box, said wiring module comprising:

a functional side having sockets adapted to removably connect with a functional module;

a wiring side opposite said functional side;

a terminal set providing a conductive portion of said sockets and adapted to electrically connect with a power cable; and

a shield disposed proximate said wiring side so as to seal said terminal set.

2. The wiring module according to claim 1 further comprising:

a front cover defining said functional side;

a back cover defining said wiring side; and

a bracket configured to mount said wiring module to said electrical box,

wherein said covers attach together so as to enclose at least a portion of said terminal set and to secure said bracket.

3. The wiring module according to claim 2 further comprising:

a plurality of wire apertures defined by said back cover;

a plurality of fixed wire terminals disposed on said terminal set; and

a plurality of fixed wires each having a stripped wire end and a connector end, each of said fixed wires extending through a corresponding one of said wire apertures so that said stripped wire end connects to a corresponding one of said fixed wire terminals, said connector end adapted to terminate at least a portion of said power cable.

4. The wiring module according to claim 3 wherein said shield comprises:

a mounting wall disposed proximate a center of said shield;

a mounting aperture defined in said mounting wall capable of accommodating a fastener so as to fixedly attach said shield to said back cover; and

plurality of knockouts extending from said mounting wall

5. The wiring module according to claim 4 wherein:

said knockouts are capable of removal so as to access breakaway portions of said terminal set,

said breakaway portions capable of removal to electrically isolate portions of said sockets.

6. A wiring module comprising:

a housing having a functional side with sockets adapted to removably connect with a functional module and an opposite wiring side;

a terminal set disposed within said housing and forming a conductive portion of said sockets; and

a plurality of wires extending through said wiring side each having a stripped end connected to said terminal set and a push-wire connector end adapted to attach to a power cable so that electrical power is communicated from said power cable to said sockets.

7. The wiring module according to claim 6 further comprising a plurality of breakaways disposed on said terminal set proximate said wiring side, said breakaways removable so as to electrically isolate portions of said terminal set;

8. The wiring module according to claim 7 further comprising a shield disposed proximate said wiring side so as to seal said terminal set.

9. The wiring module according to claim 8 wherein said shield comprises a plurality of knockouts removable from said shield so as to provide access to said breakaways.

10. The wiring module according to 9 wherein said housing further comprises a plurality of wire apertures each adapted for a corresponding one of said wires so as to provide a seal around and strain relief for said wires and access to said terminal set.

11. The wiring module according to claim 10 further comprising a bracket configured to mount said wiring module to an electrical box, said housing enclosing at least a portion of said bracket so as to secure said bracket to said housing.

12. A wiring module adapted to an electrical box comprising:

a front cover defining a functional side;

a back cover defining a wiring side;

a plurality of sockets disposed on said functional side adapted to connect to a functional module;

a terminal set providing a conductive portion of said sockets; and

a plurality of push wire connectors accessible from said wiring side and in electrical communication with said terminal set, said push wire connectors adapted to connect to a power cable so as to transfer electrical power to said sockets.

13. The wiring module according to claim 12 further comprising a shield disposed proximate said wiring side so as to seal said terminal set.

14. The wiring module according to claim 13 further comprising a plurality of breakaways disposed on said terminal set proximate said wiring side, said breakaways removable so as to electrically isolate portions of said terminal set.

15. The wiring module according to claim 14 further comprising a plurality of wires extending through said wiring side each having a first end connected to said terminal set and a second end connected to said push wire connector.

16. The wiring module according to claim 15 further comprising a plurality of wire apertures defined by said back cover and configured for a corresponding one of said wires so as to provide a seal around and strain relief for said wires and access to said terminal set.

17. The wiring module according to claim 16 further comprising a plurality of breakaway apertures defined by said back cover and that allow access to said breakaways, said shield configured to enclose said breakaway apertures.

18. The wiring module according to claim 17 wherein said shield comprises a plurality of knockouts removable from said shield so as to provide access to said breakaways.

19. The wiring module according to claim 18 further comprising a bracket, said bracket secured between said covers.

20. The wiring module according to claim 19 wherein said bracket has a plurality of module mounts adapted to secure said functional module to said wiring module.

* * * * *

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Gorman

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(45) **Date of Patent: Sep. 4, 2007**

(54) **ELECTRICAL DISTRIBUTION WIRING MODULE**

(75) Inventor: **Michael P. Gorman**, Laguna Niguel, CA (US)

(73) Assignee: **ProtectConnect, Inc.**, Irvine, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **May 3, 2006**

Related U.S. Application Data

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(60) Provisional application No. 60/631,244, filed on Nov. 26, 2004, provisional application No. 60/441,852, filed on Jan. 21, 2003, provisional application No. 60/383,269, filed on May 23, 2002.

(51) **Int. Cl.**
H02G 3/14 (2006.01)

(52) **U.S. Cl.** **174/66**; 439/536

(58) **Field of Classification Search** 439/536, 439/537, 892; 174/66, 67
See application file for complete search history.

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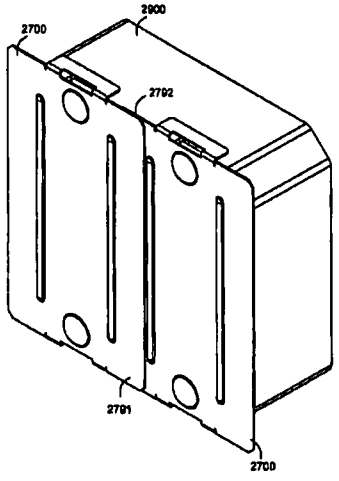
Primary Examiner—Gary F. Paumen
(74) *Attorney, Agent, or Firm*—Knobbe Martens Olson & Bear LLP

(57) **ABSTRACT**

A wiring module is installed within an electrical box, wherein the wiring module is configured to connect to a power cable routed to the electrical box. The wiring module distributes electrical power according to a functional module that is pluggable into the wiring module. A cover is removably mounted to the wiring module so that the cover extends generally flush over an open face of the electrical box. The cover prevents plaster and other material from fouling the wiring module during wall panel installation and is removed after wall panel installation so as to plug the functional module into the wiring module.

7 Claims, 43 Drawing Sheets



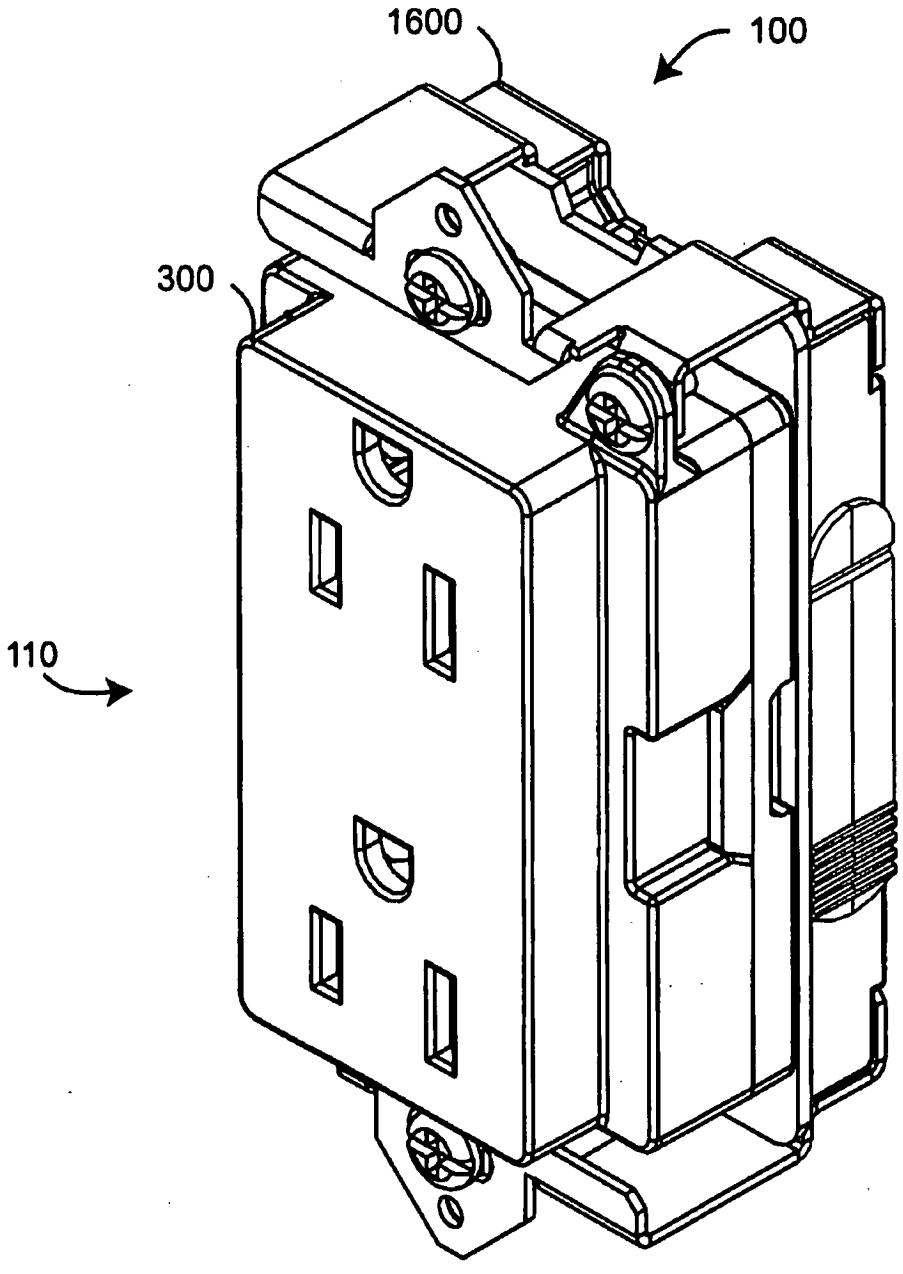


FIG. 1A

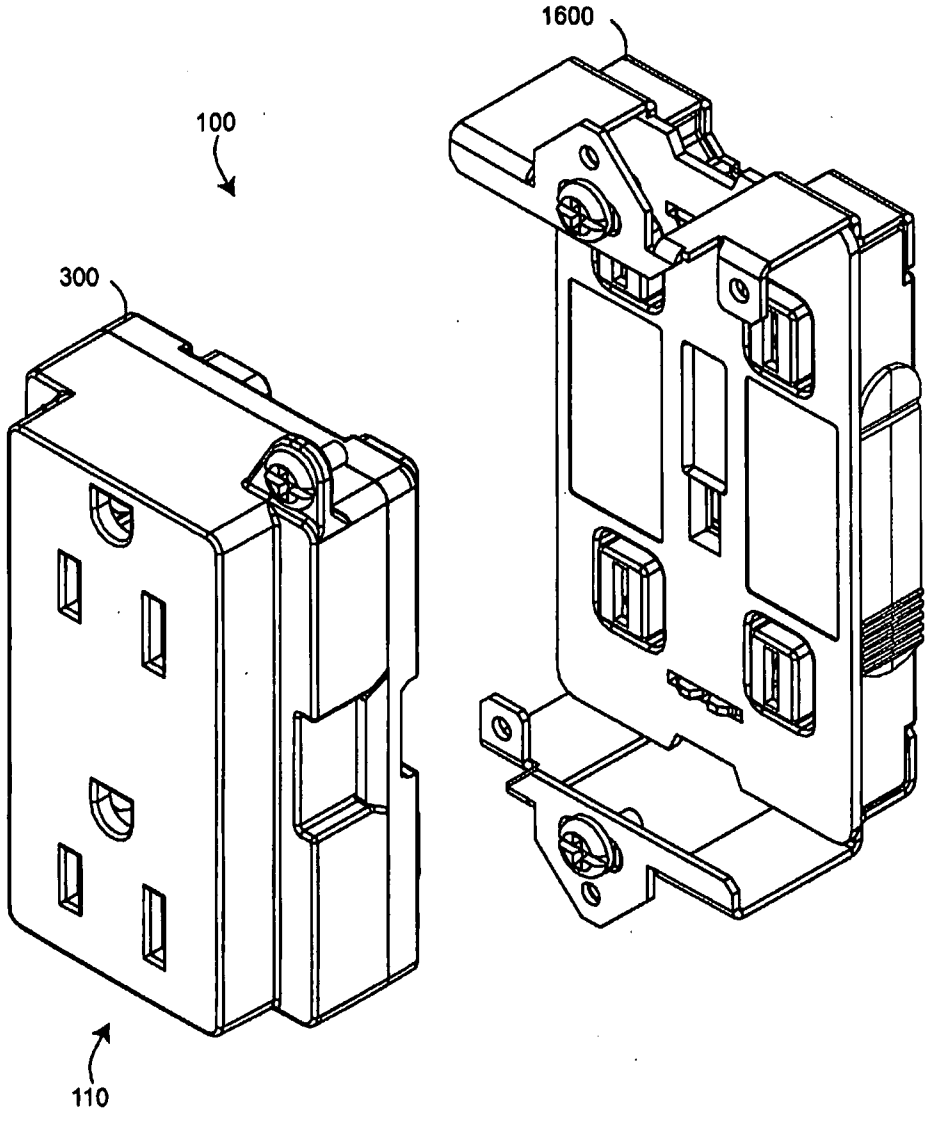


FIG. 1B

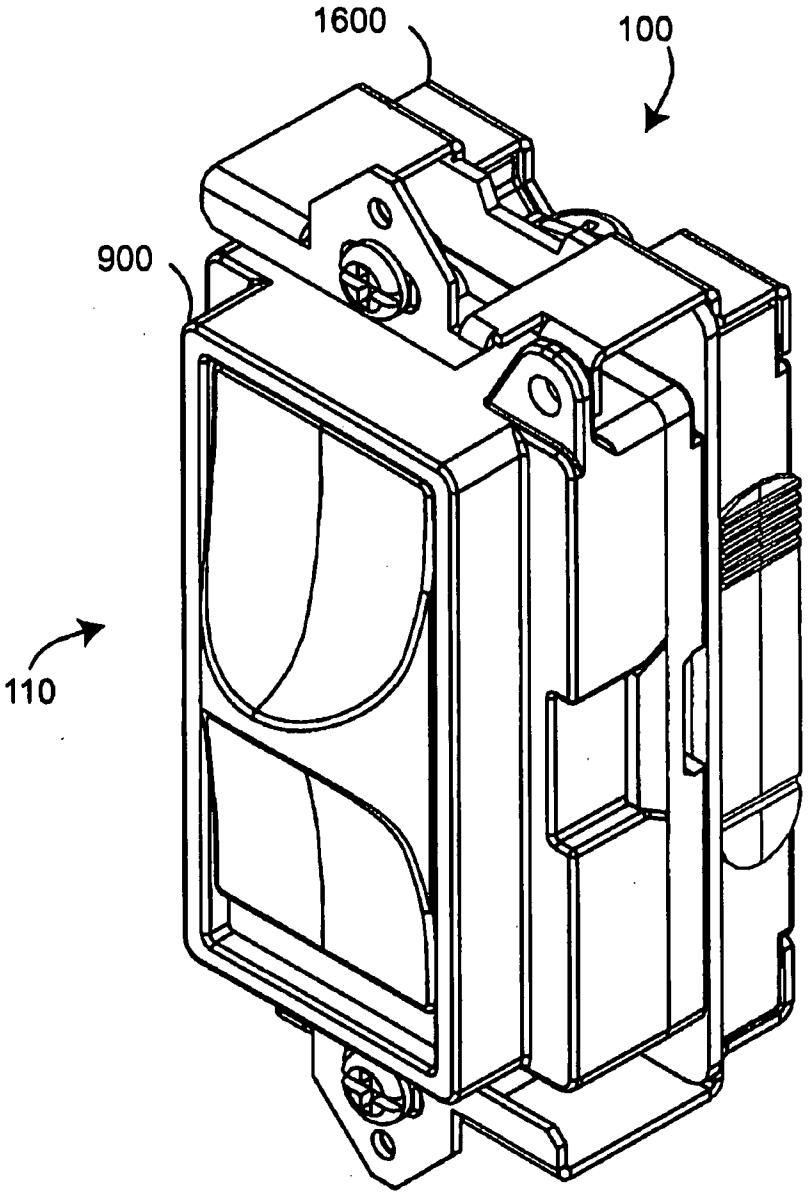


FIG. 2A

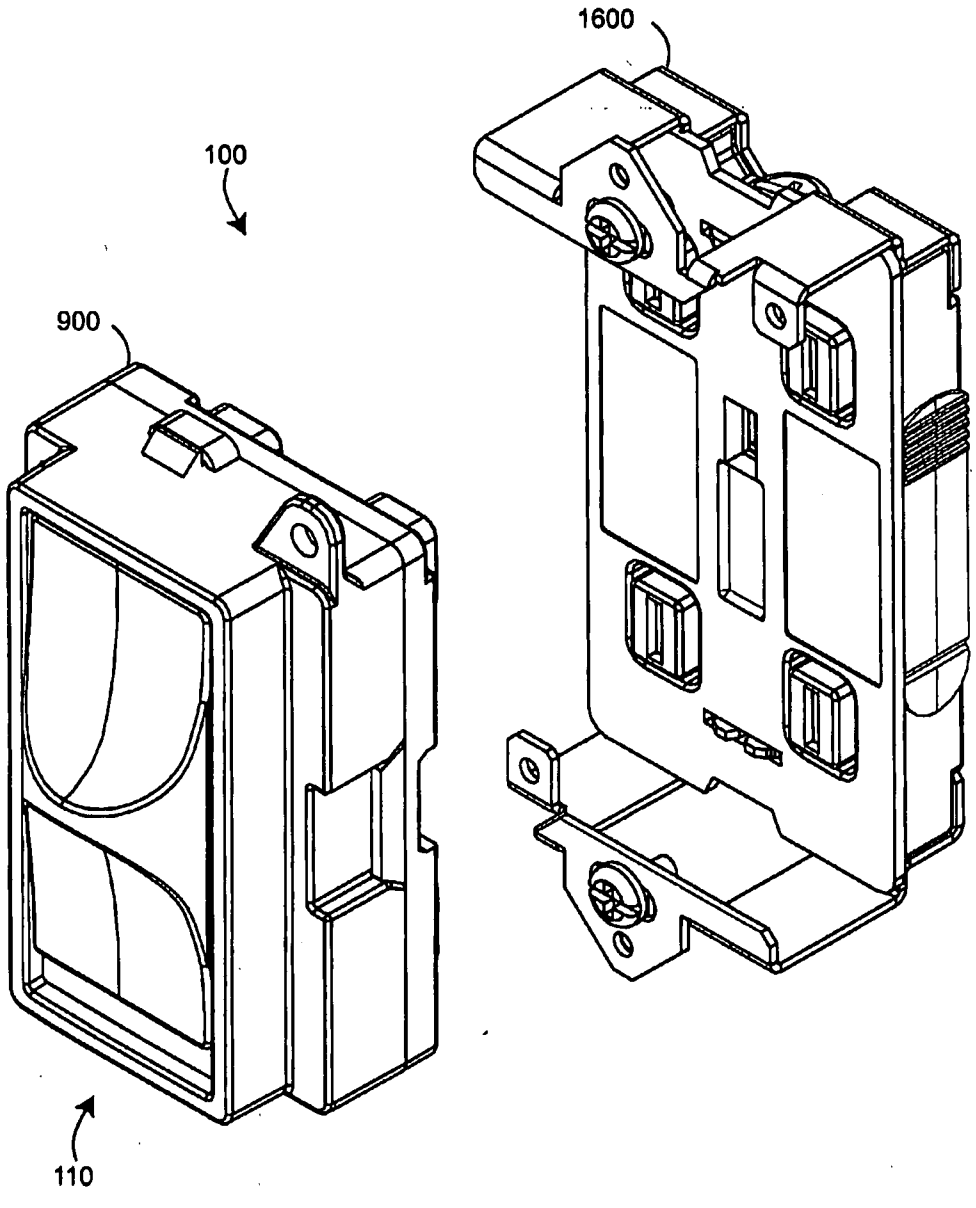


FIG. 2B

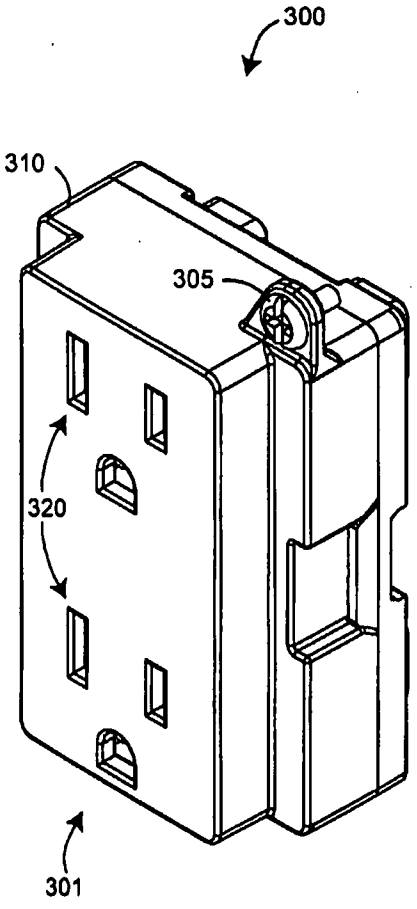


FIG. 3A

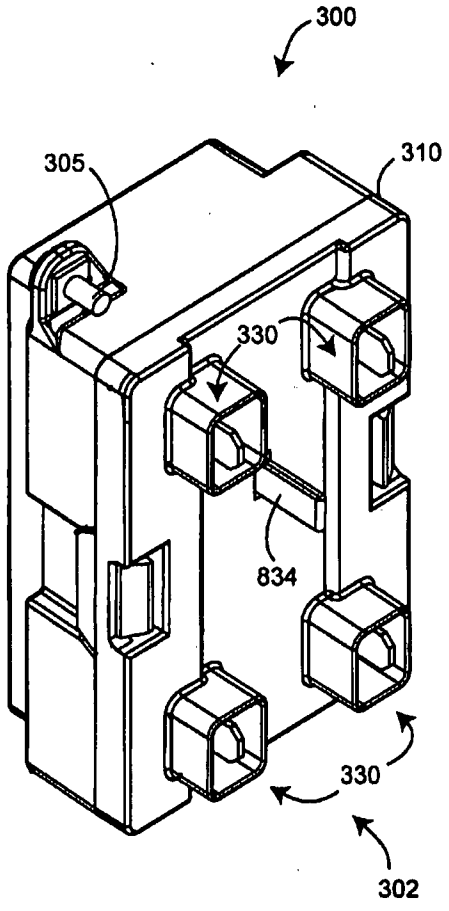


FIG. 3B

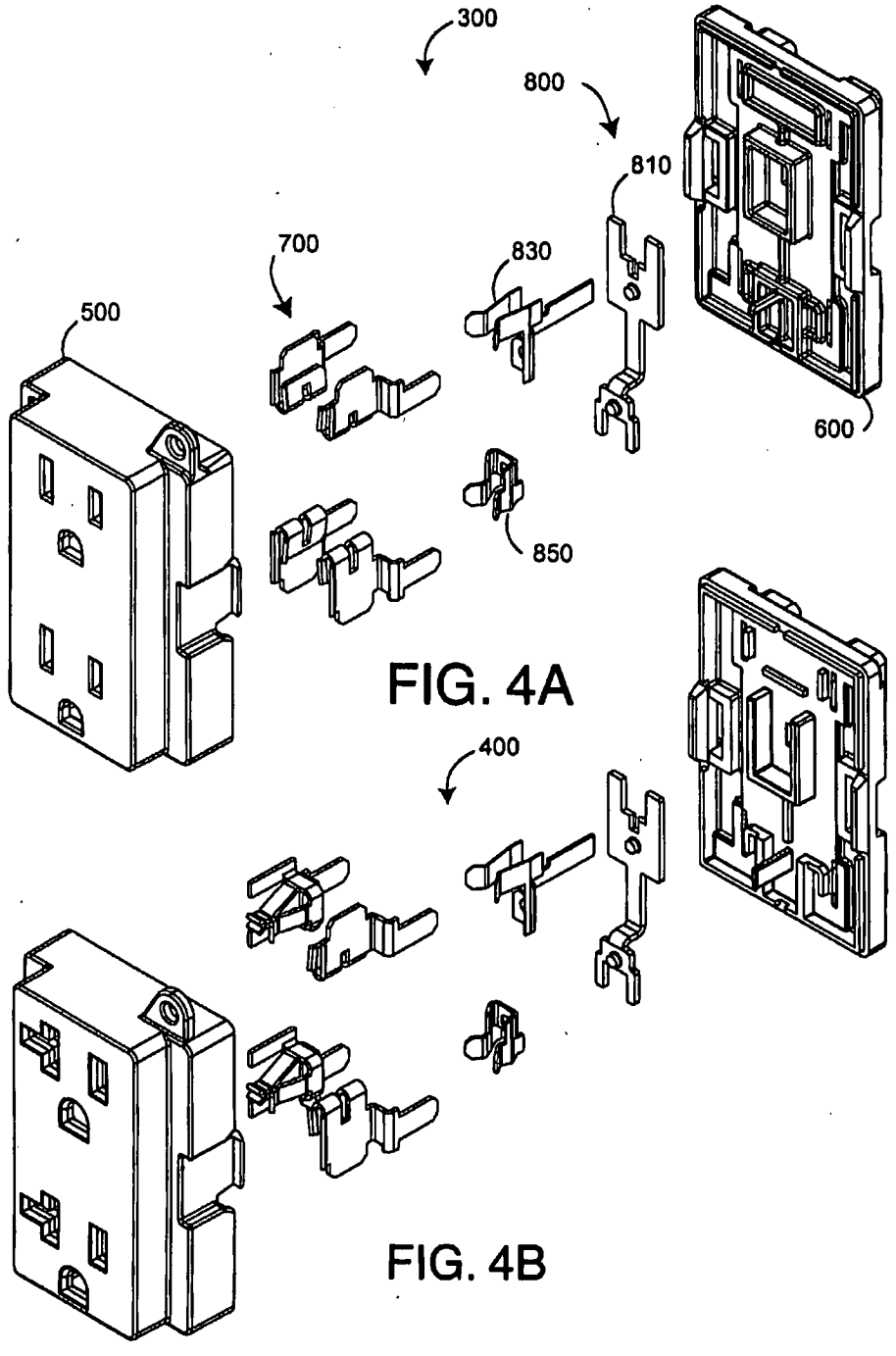


FIG. 4A

FIG. 4B

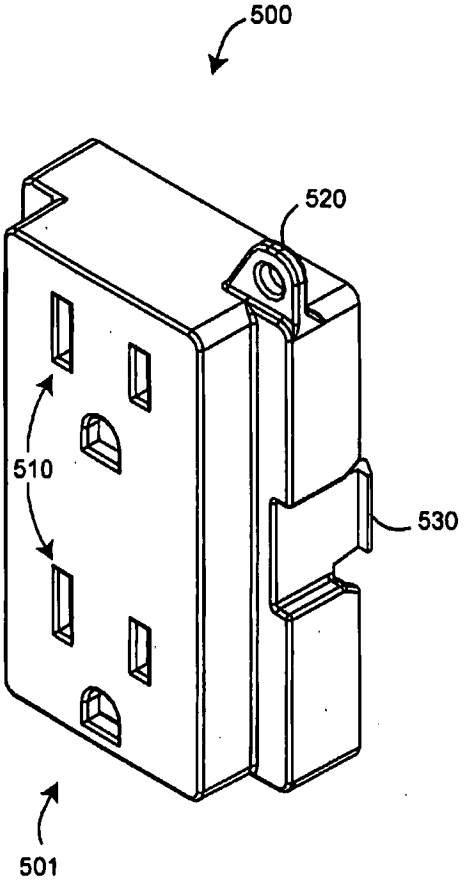


FIG. 5A

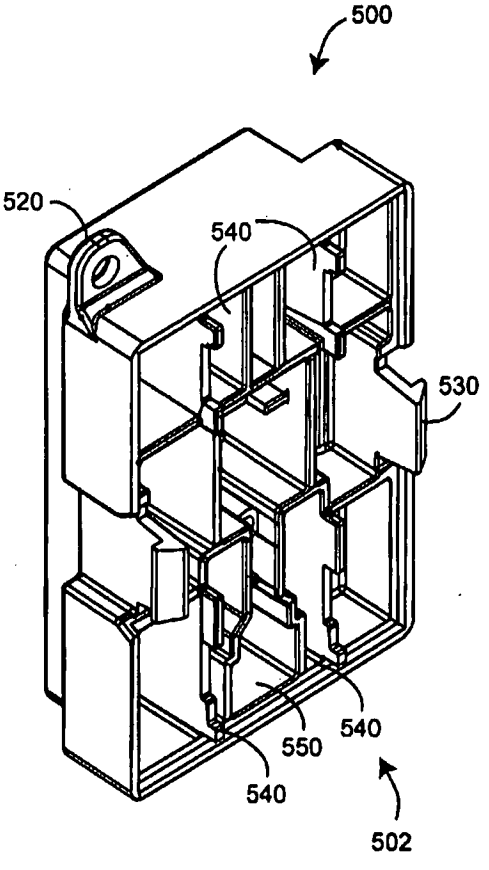


FIG. 5B

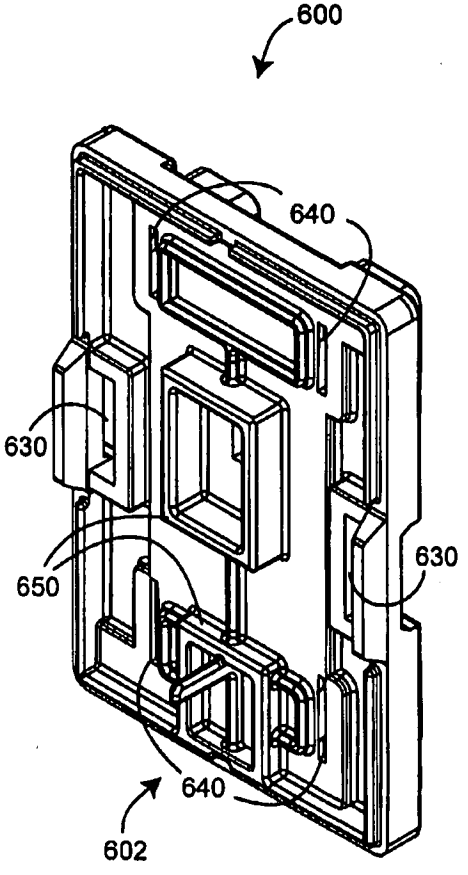


FIG. 6A

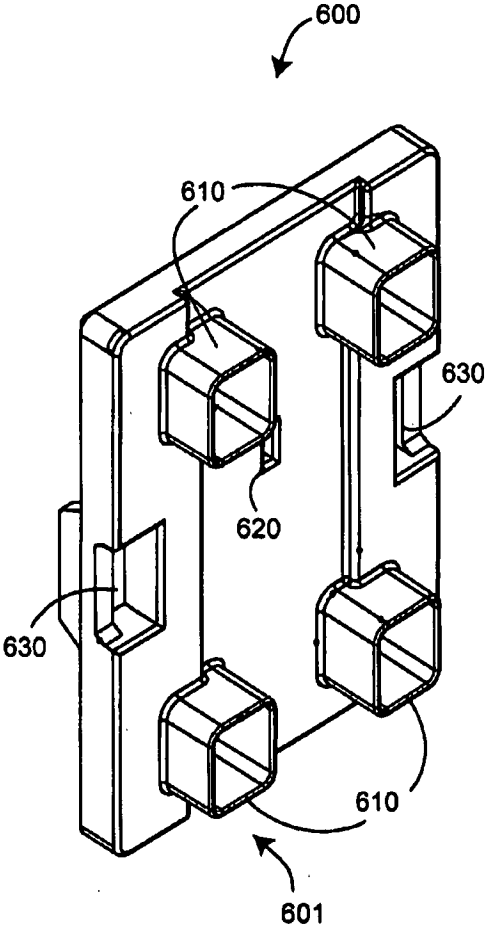


FIG. 6B

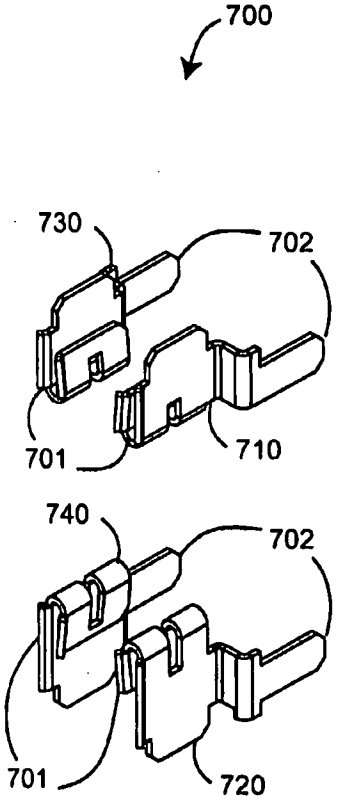


FIG. 7A

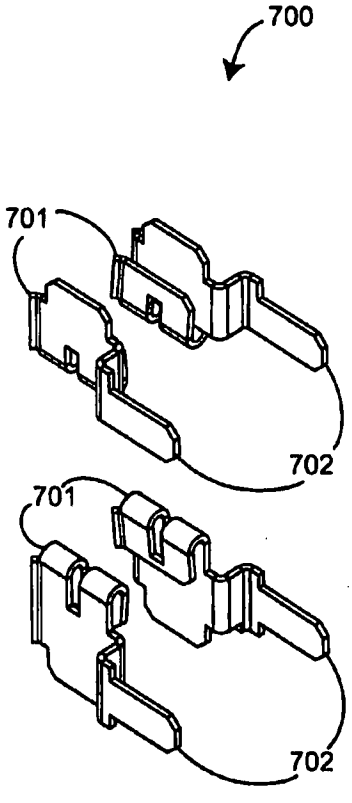


FIG. 7B

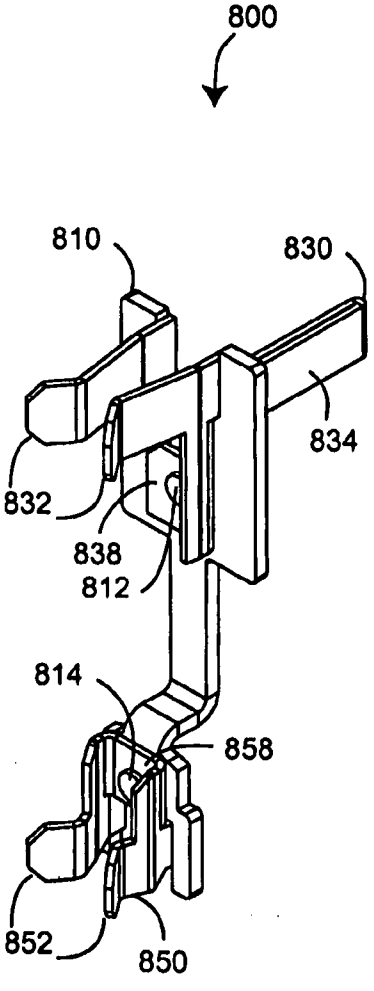

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FIG. 8A

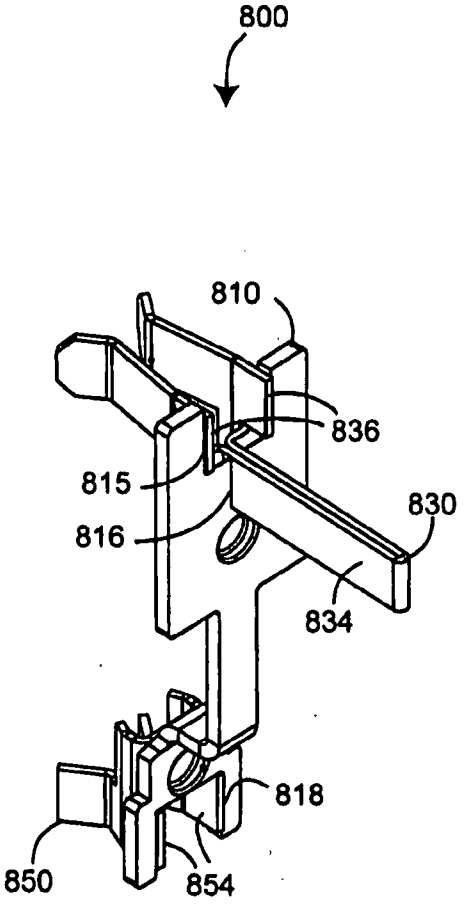
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FIG. 8B

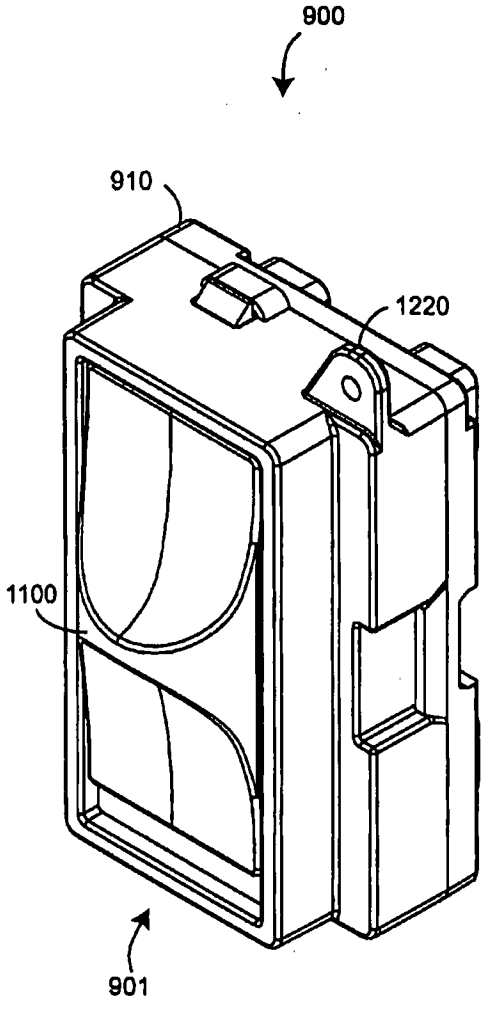

FIG. 9A

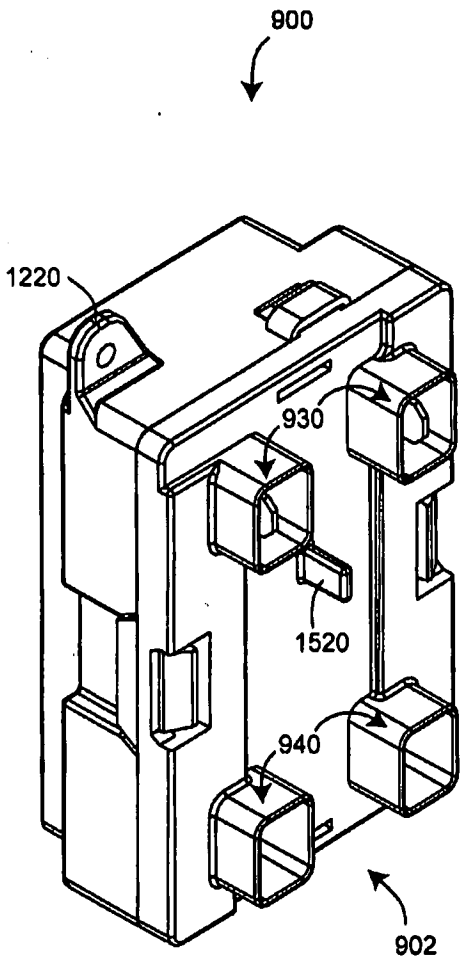

FIG. 9B

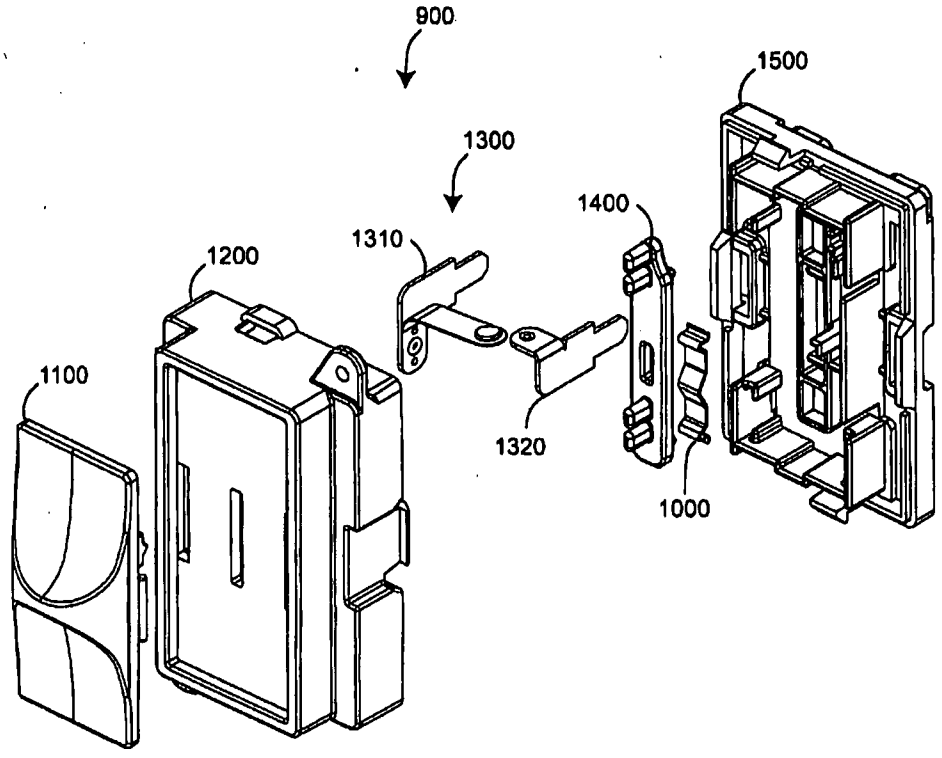

FIG. 10

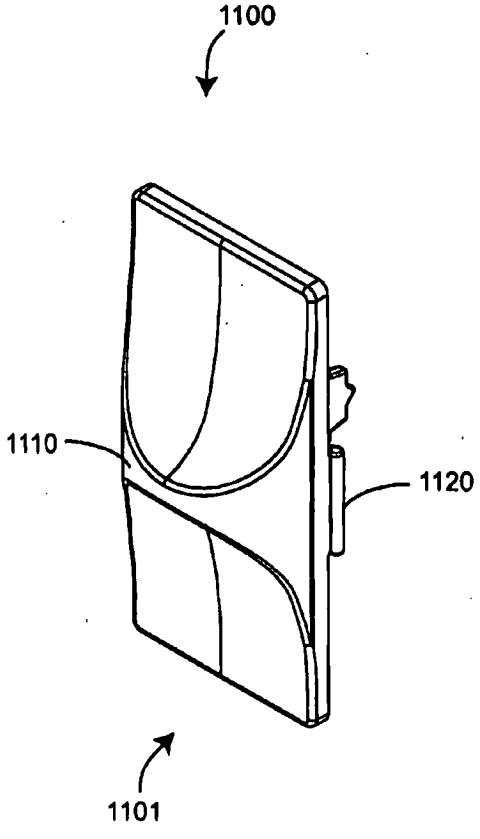

FIG. 11A

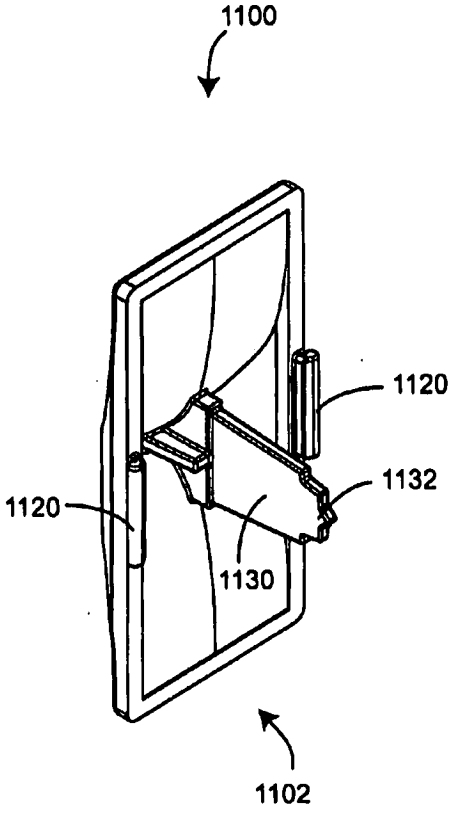

FIG. 11B

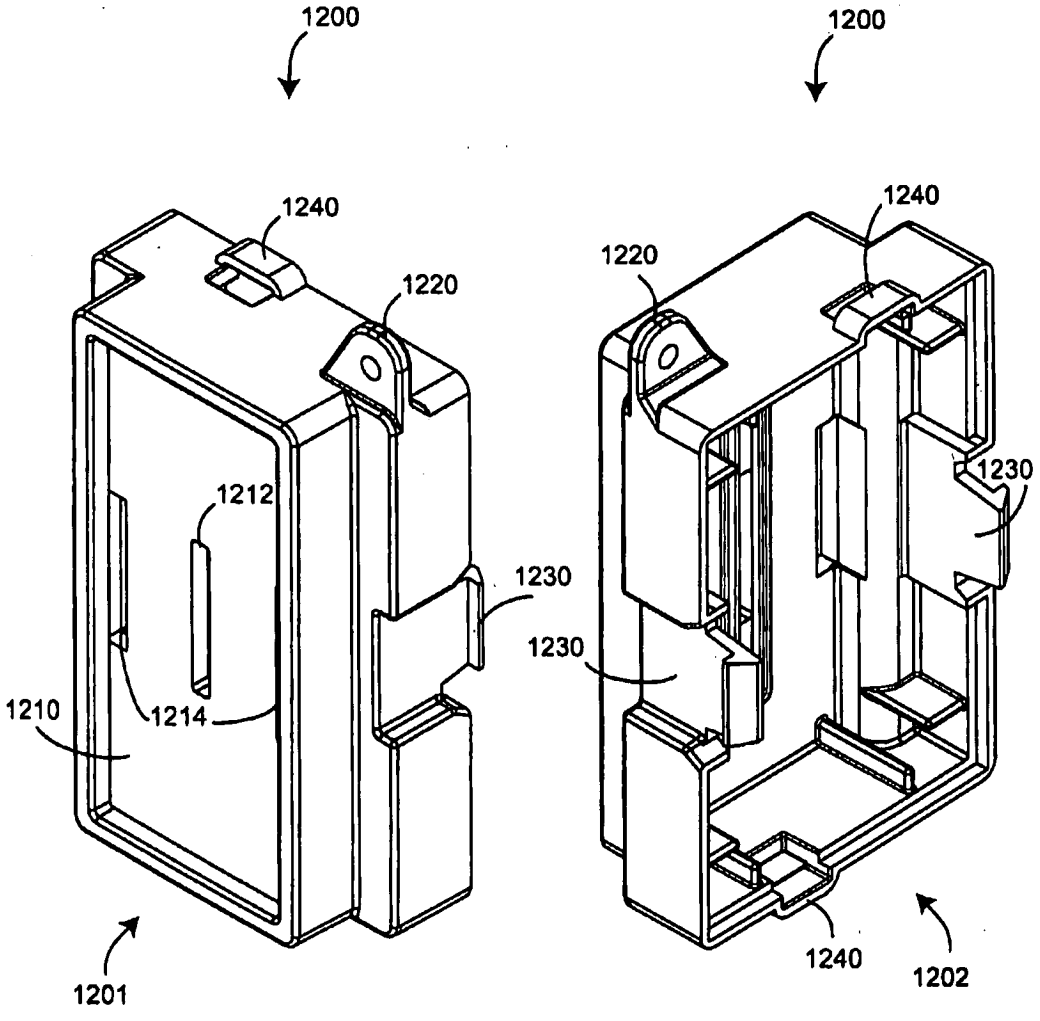

FIG. 12A

FIG. 12B

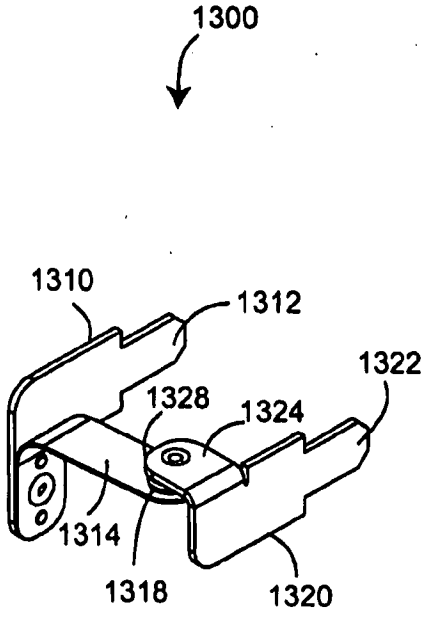

FIG. 13A

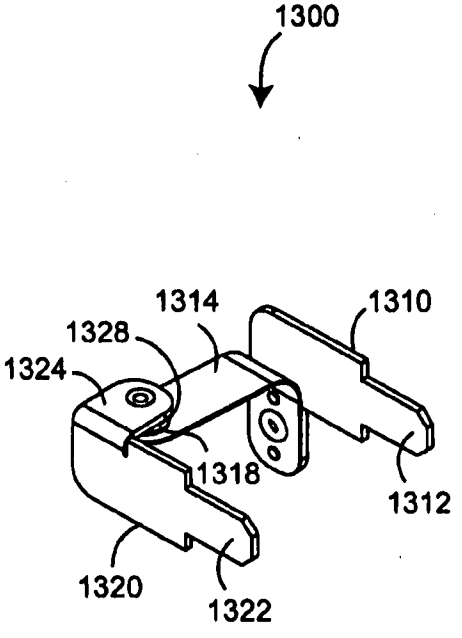

FIG. 13B

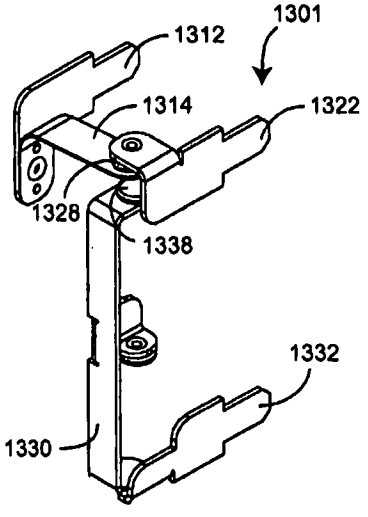

FIG. 13C

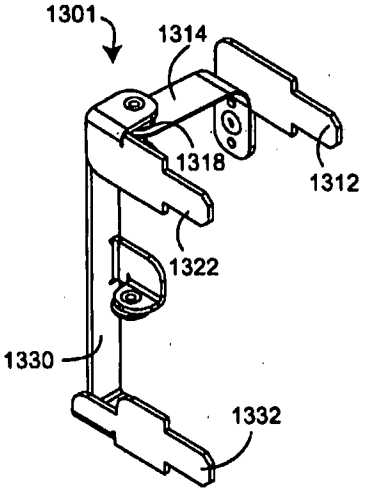

FIG. 13D

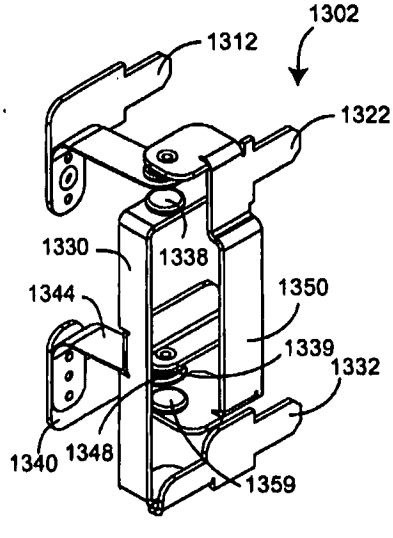

FIG. 13E

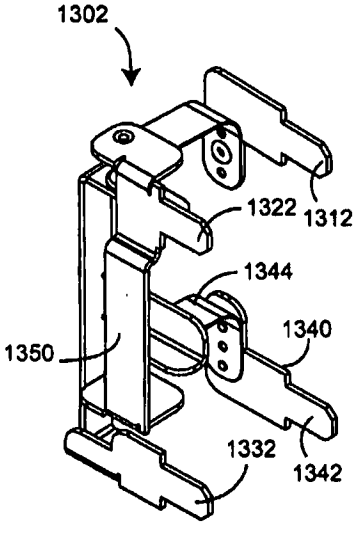

FIG. 13F

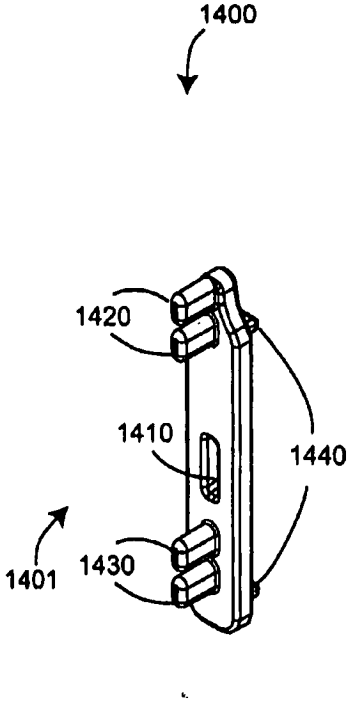

FIG. 14A

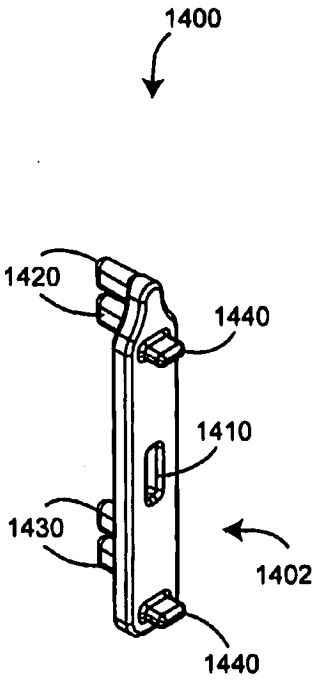

FIG. 14B

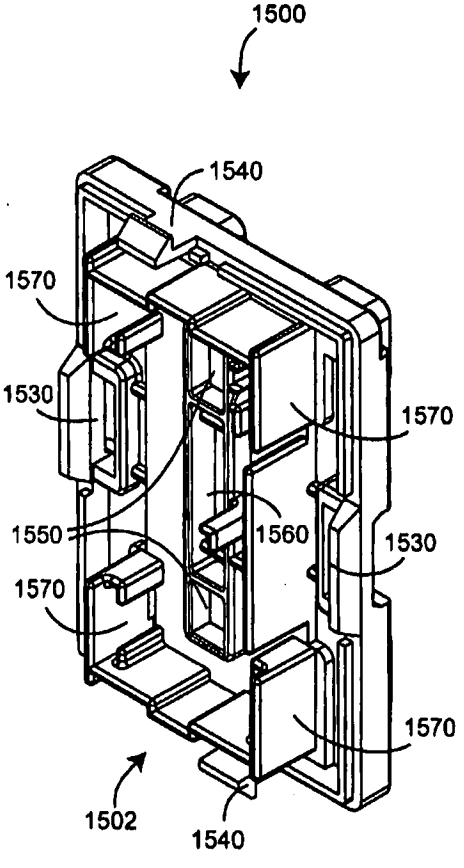

FIG. 15A

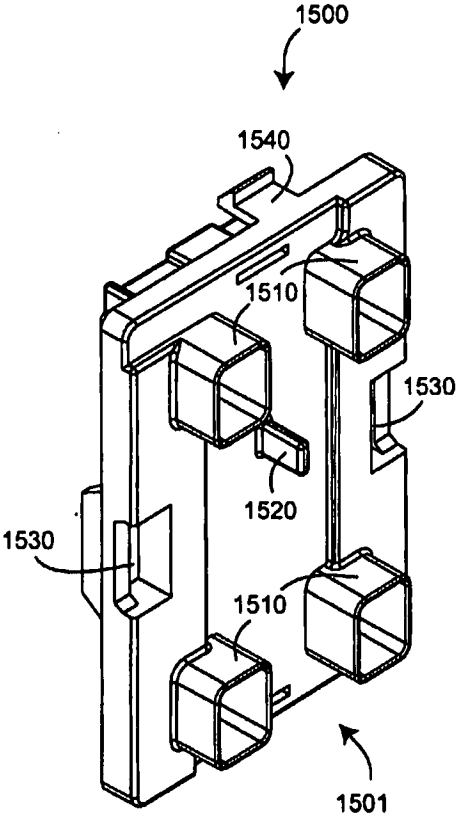

FIG. 15B

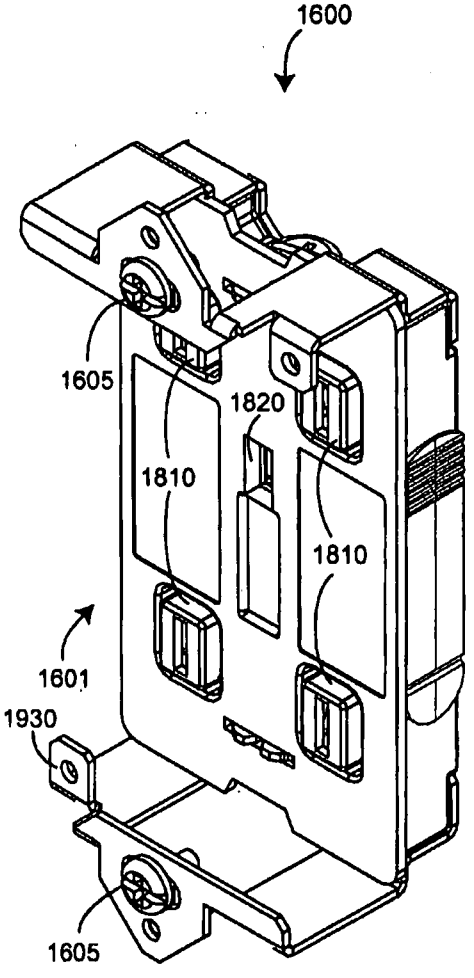

FIG. 16A

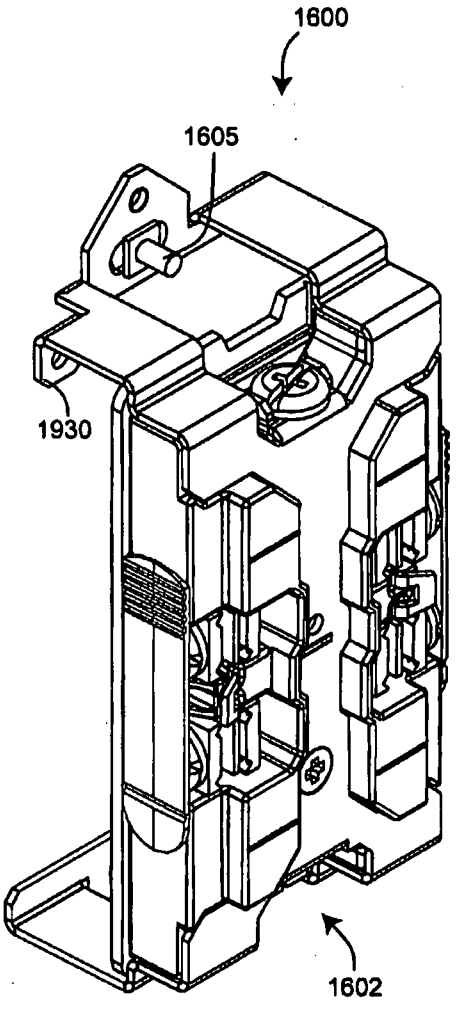

FIG. 16B

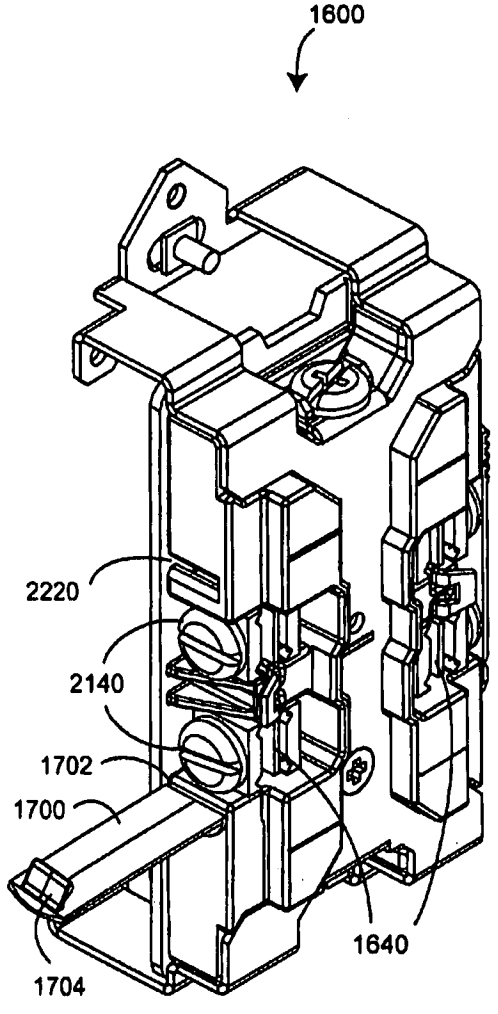

FIG. 16C

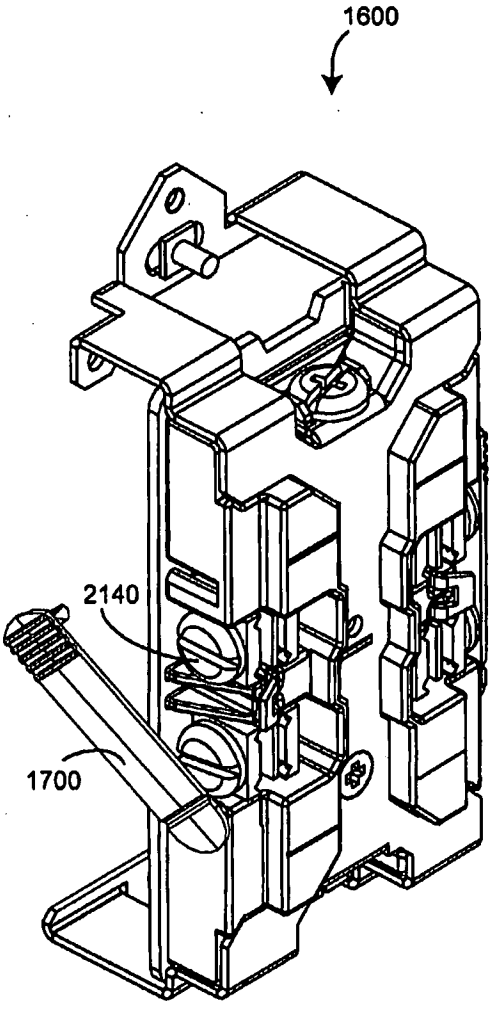

FIG. 16D

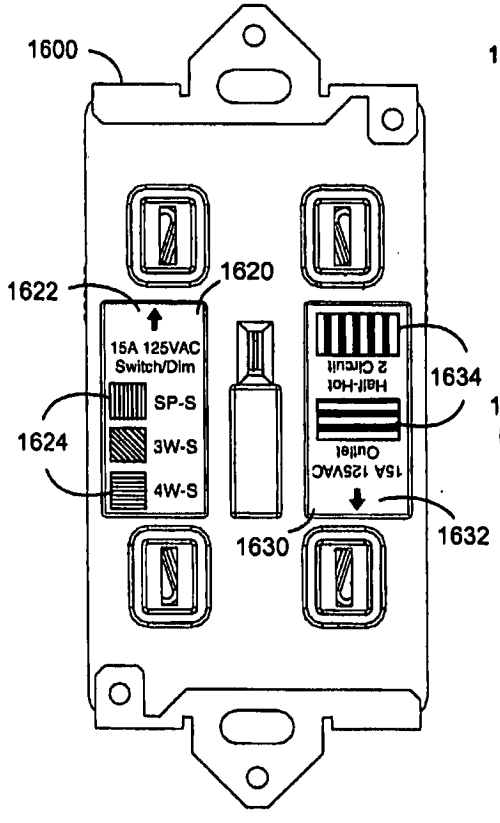

FIG. 16E

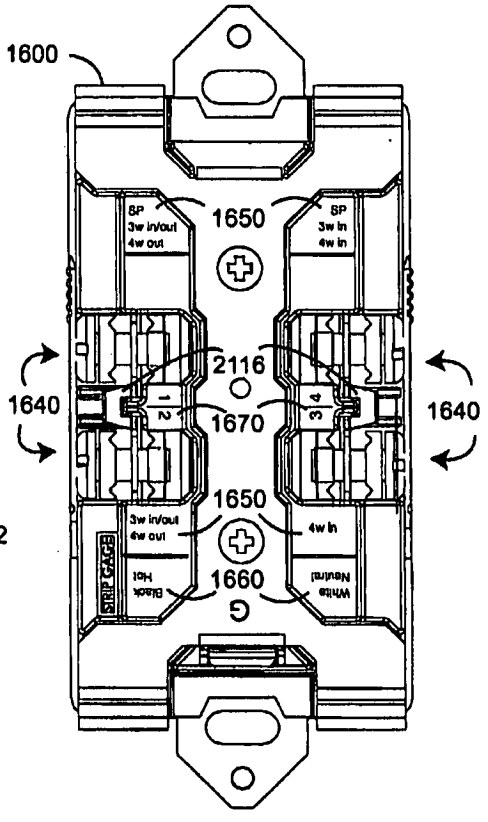

FIG. 16F

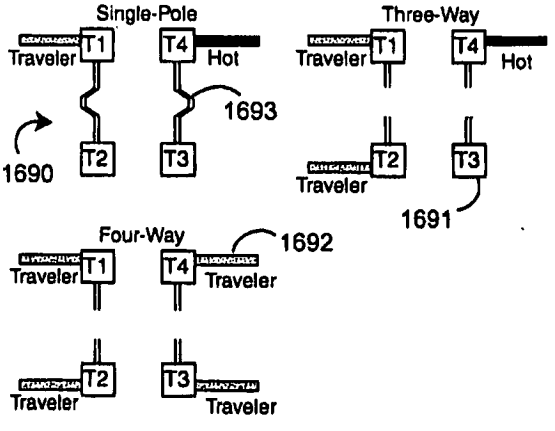

FIG. 16G

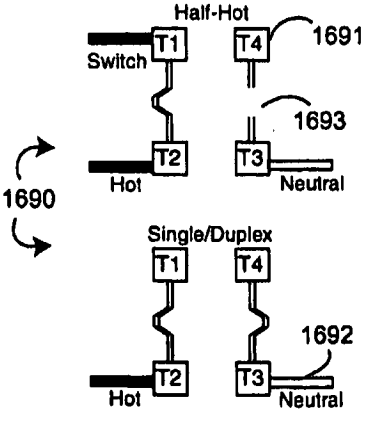

FIG. 16H

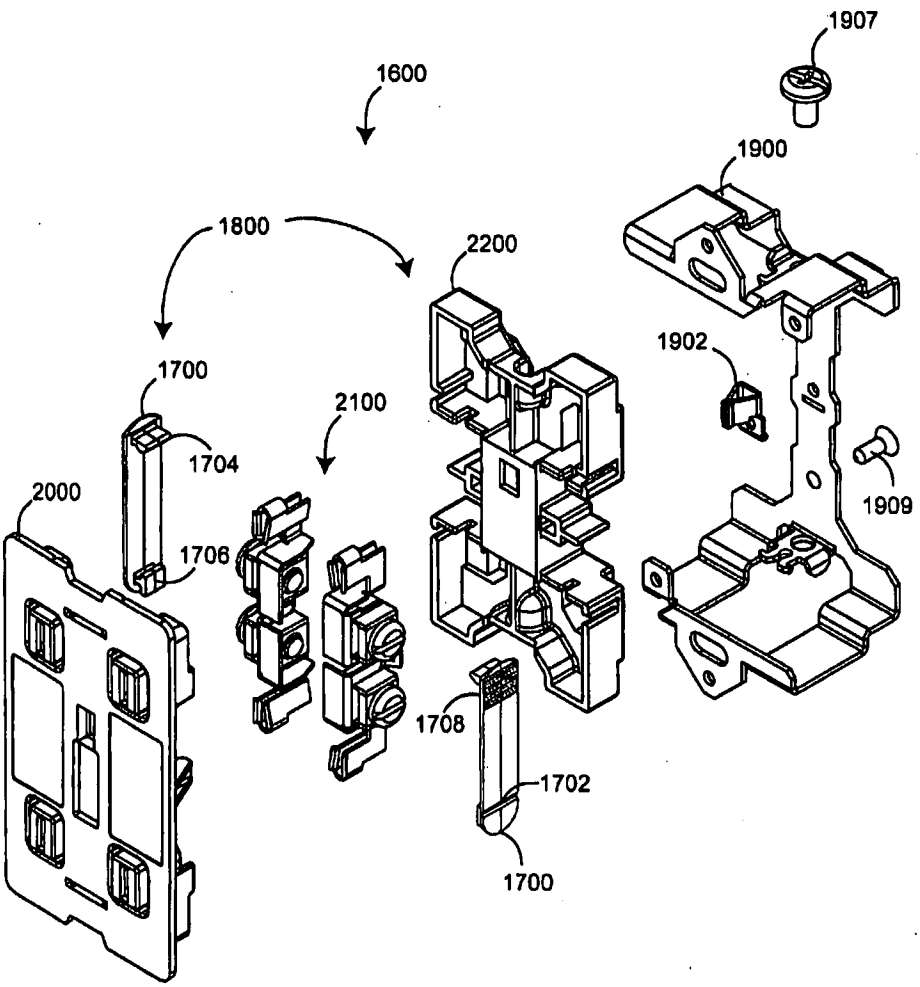
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FIG. 17A

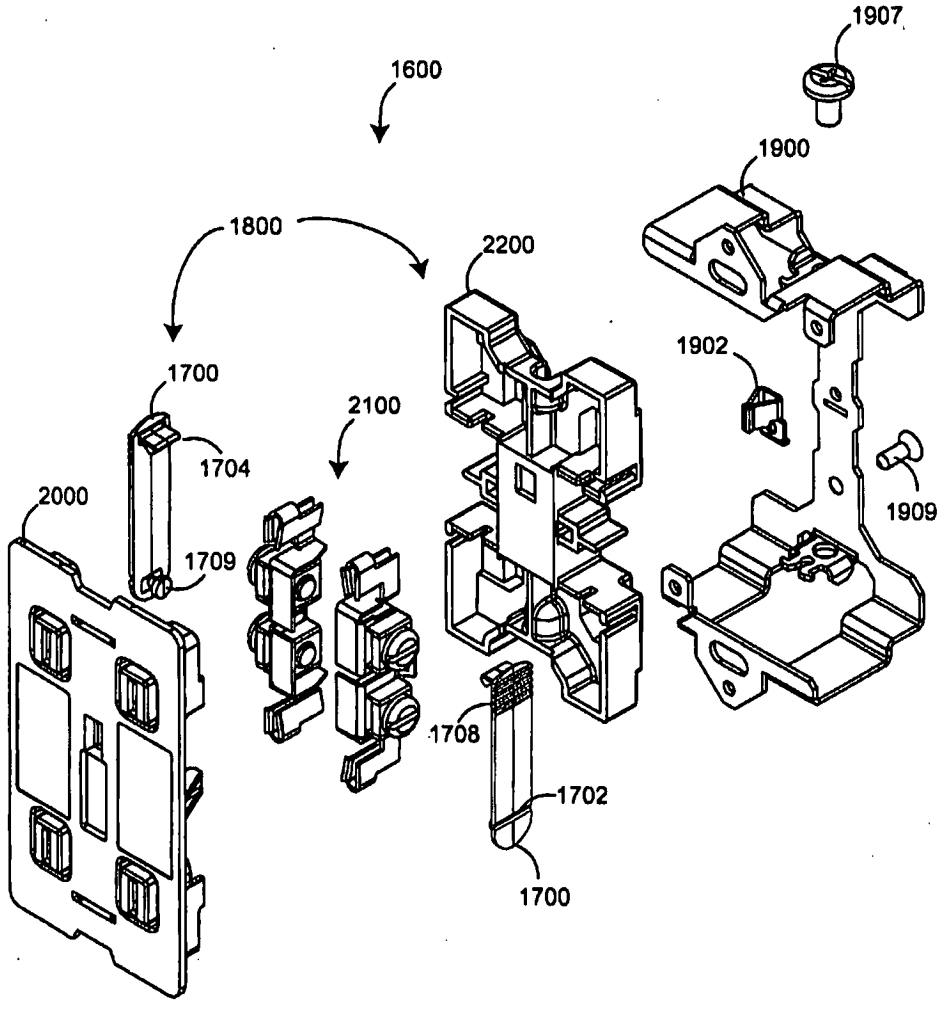
1907
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FIG. 17B

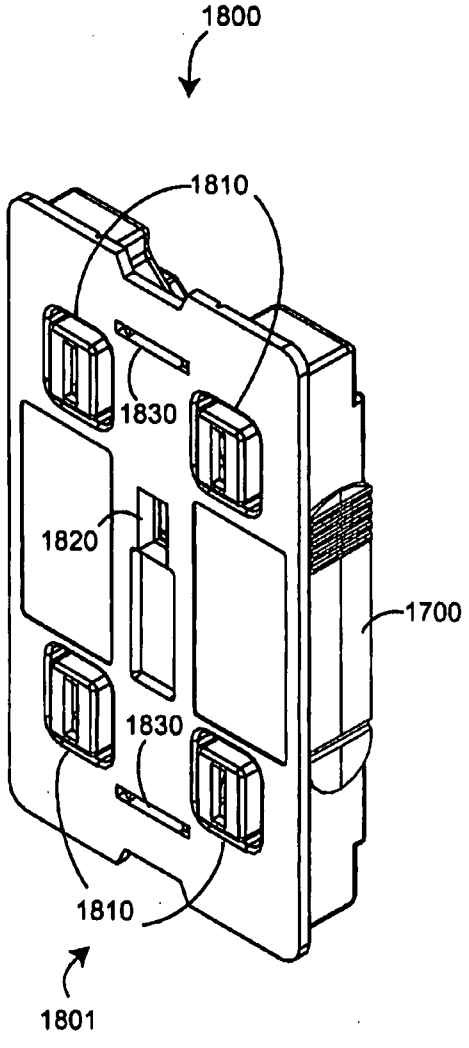

FIG. 18A

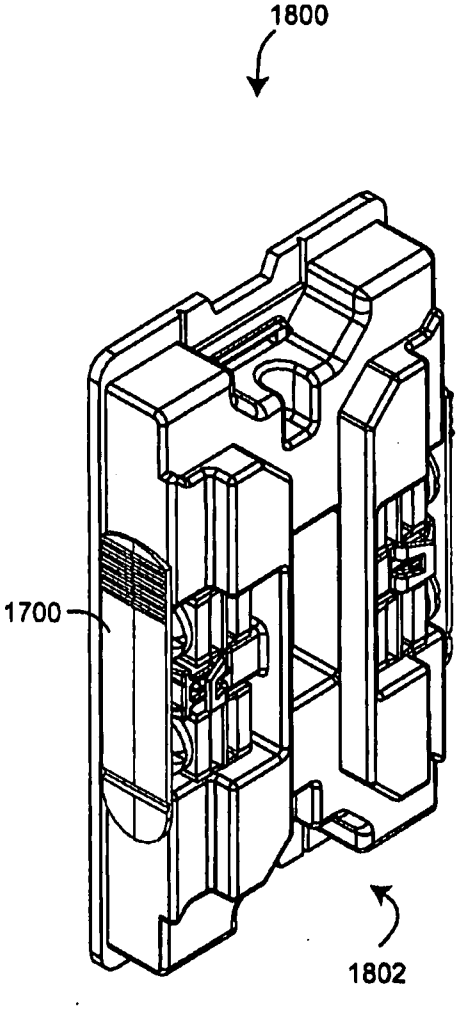

FIG. 18B

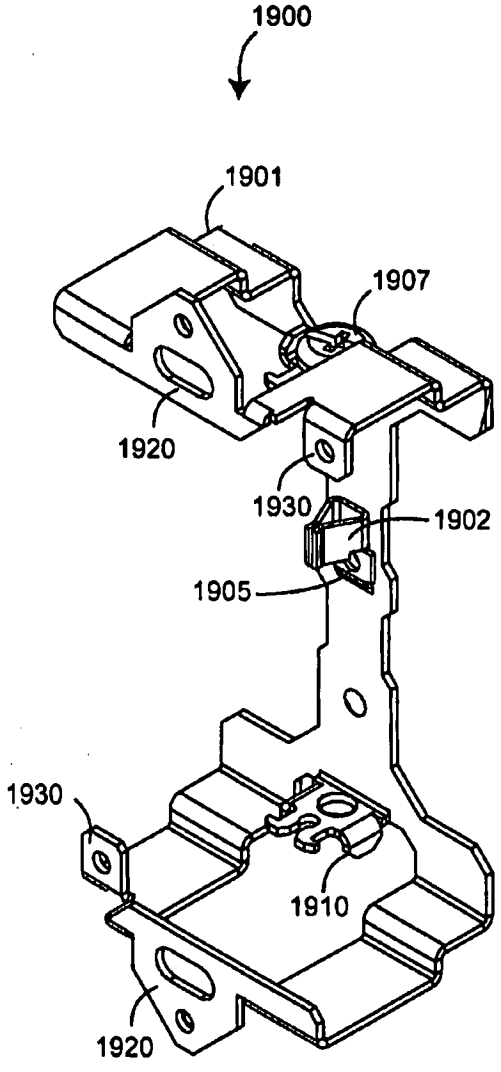

FIG. 19A

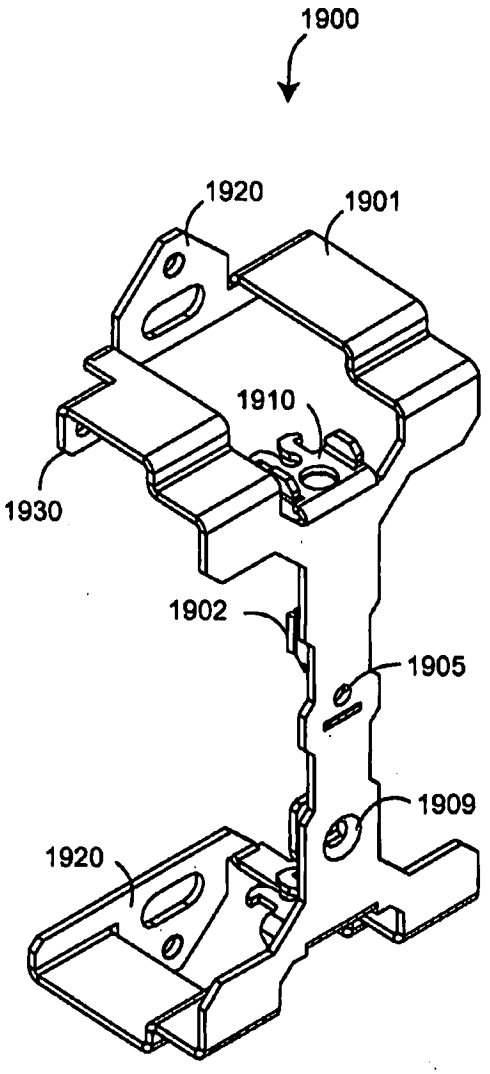

FIG. 19B

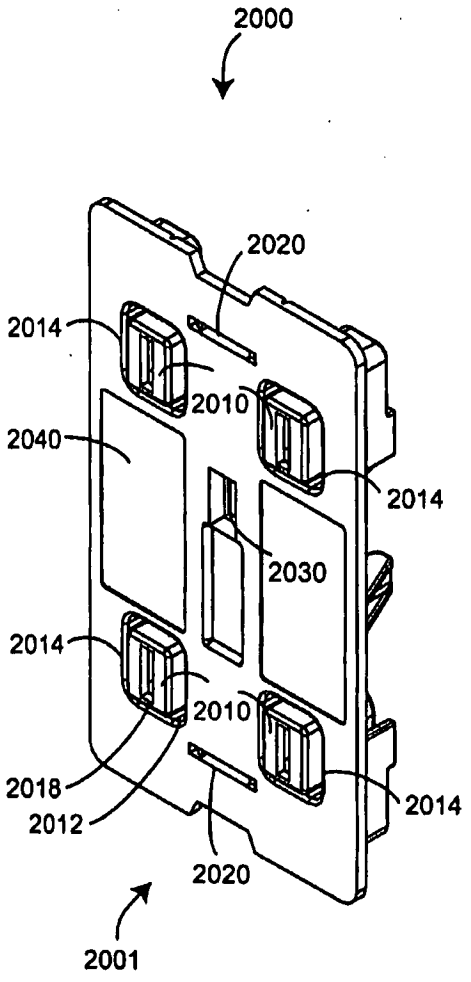

FIG. 20A

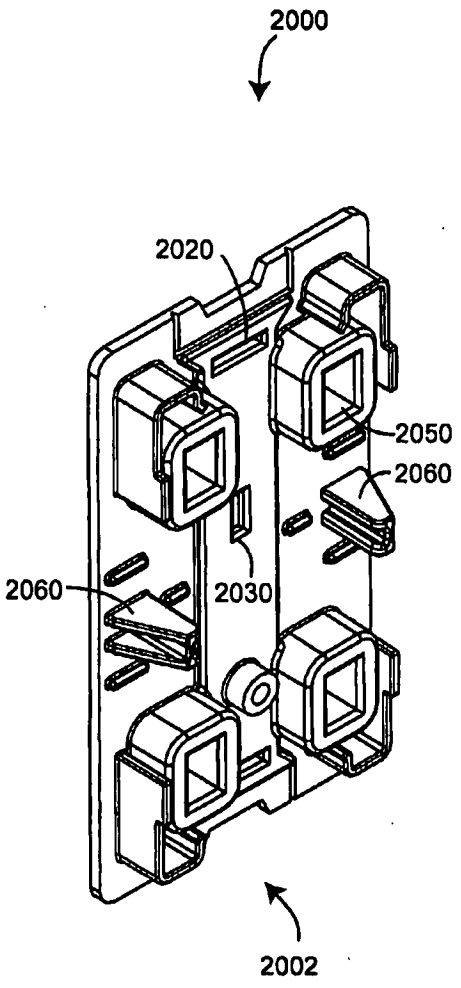

FIG. 20B

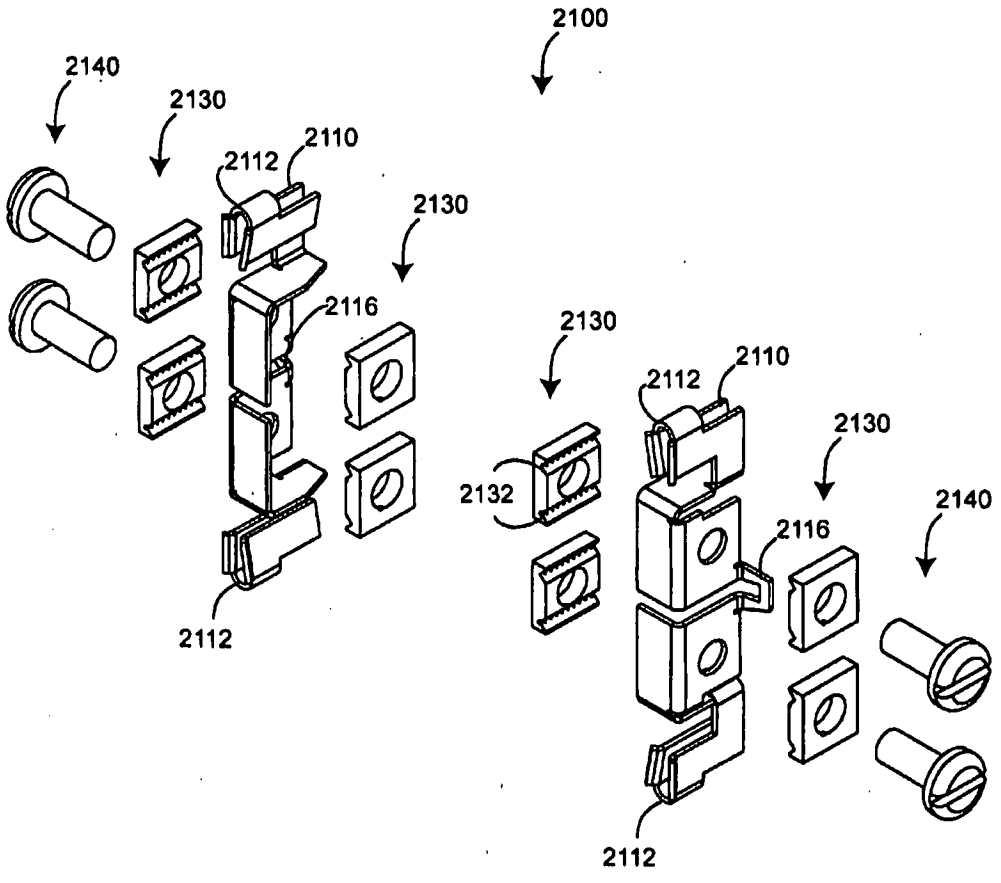
2100
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FIG. 21

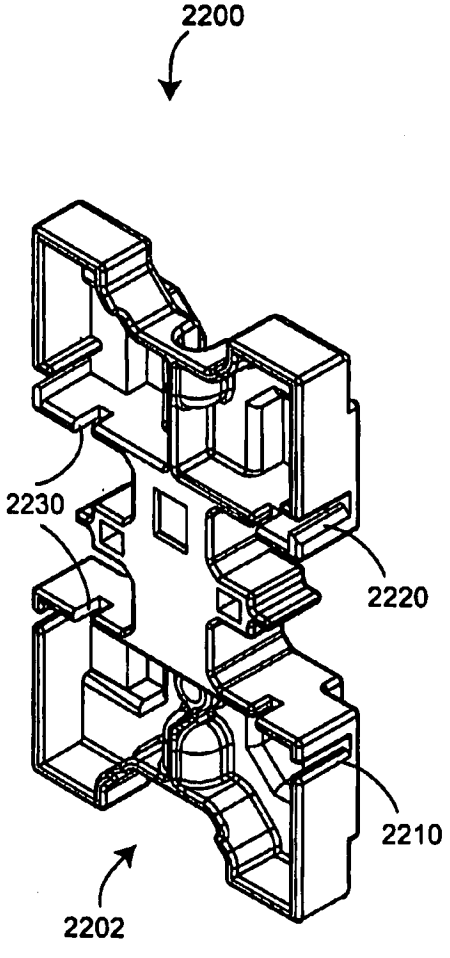

FIG. 22A

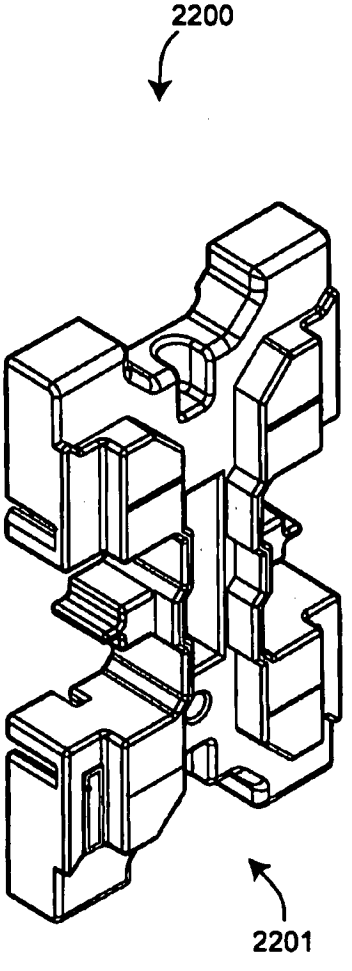

FIG. 22B

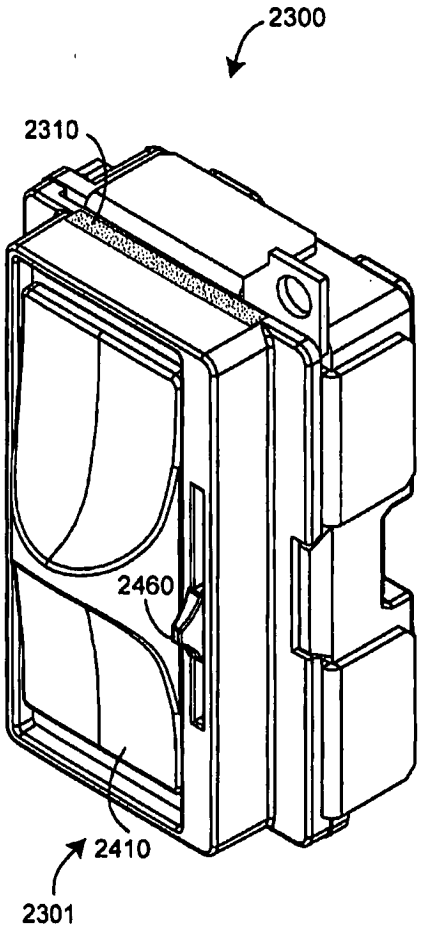

FIG. 23A

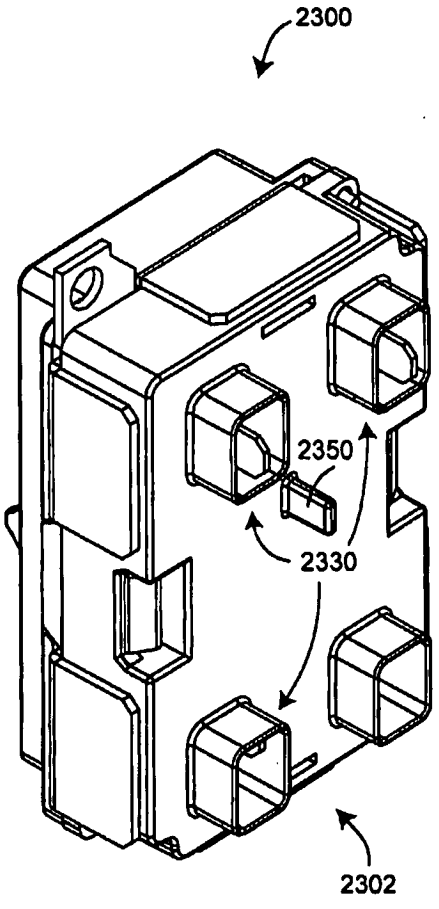

FIG. 23B

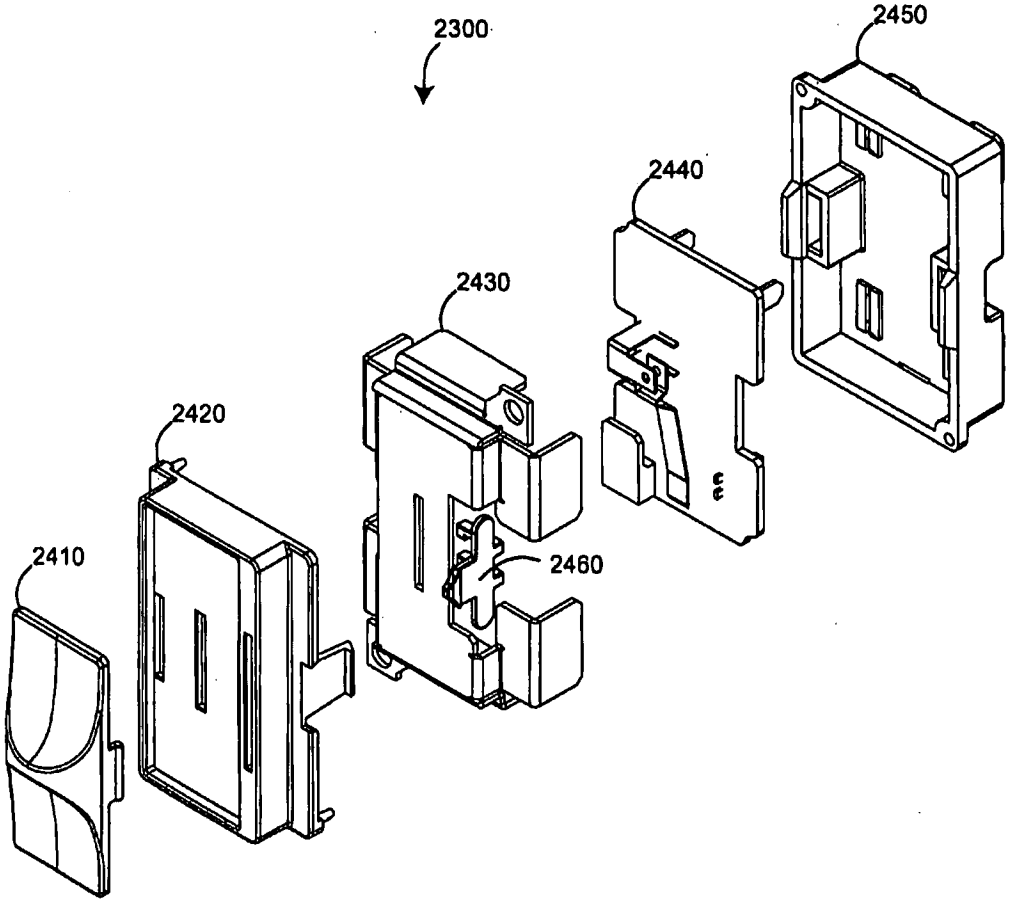

FIG. 24

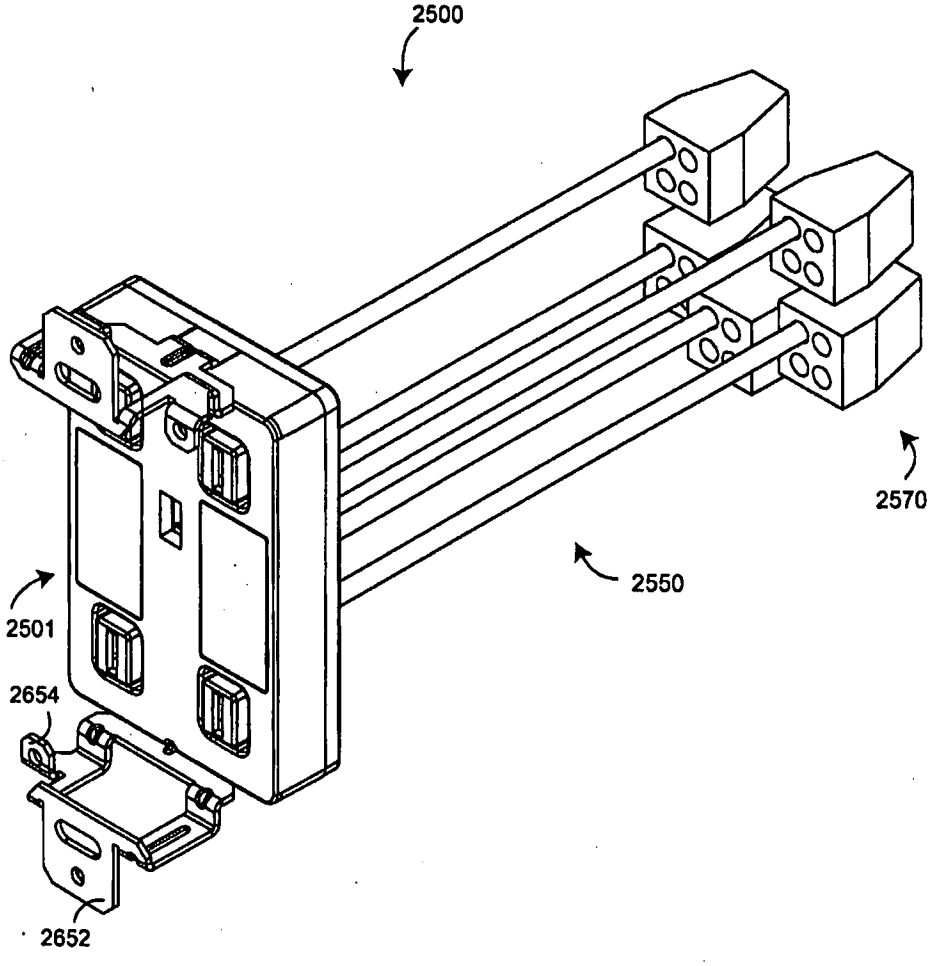

FIG. 25A

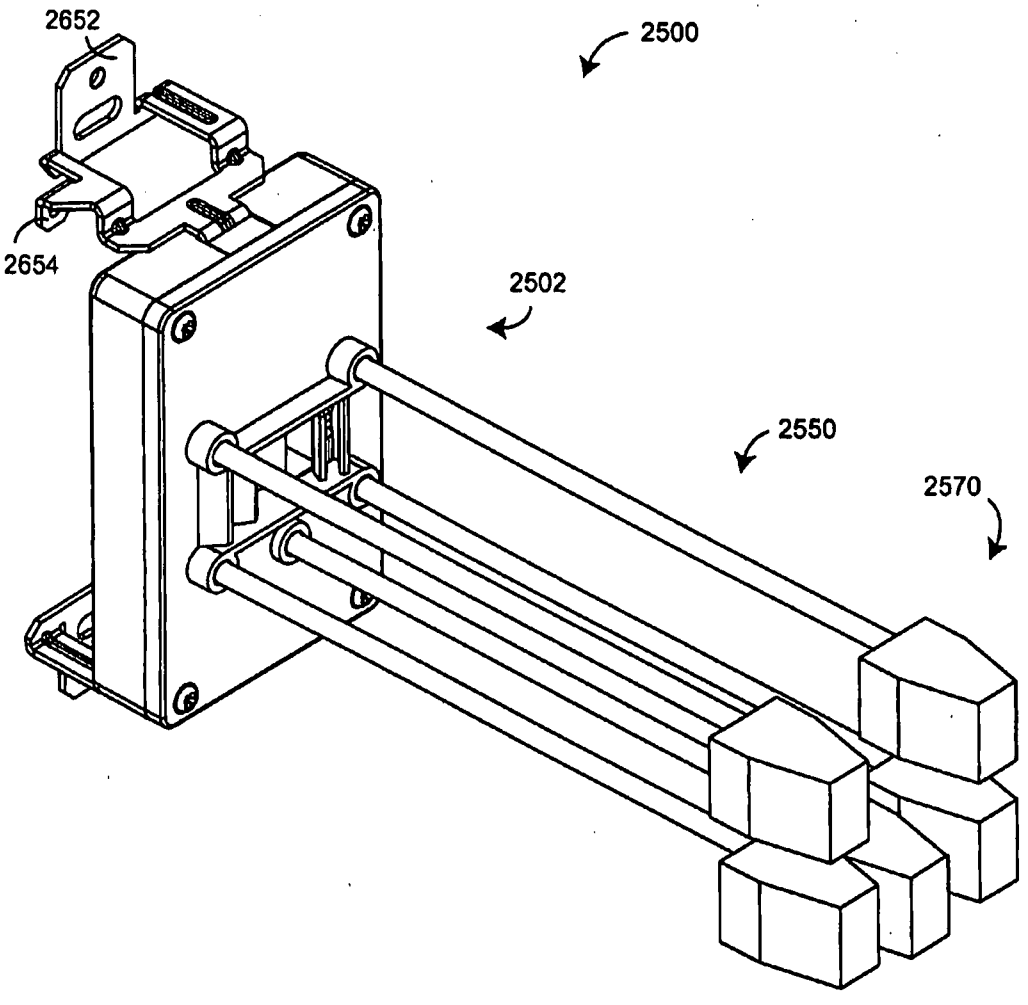

FIG. 25B

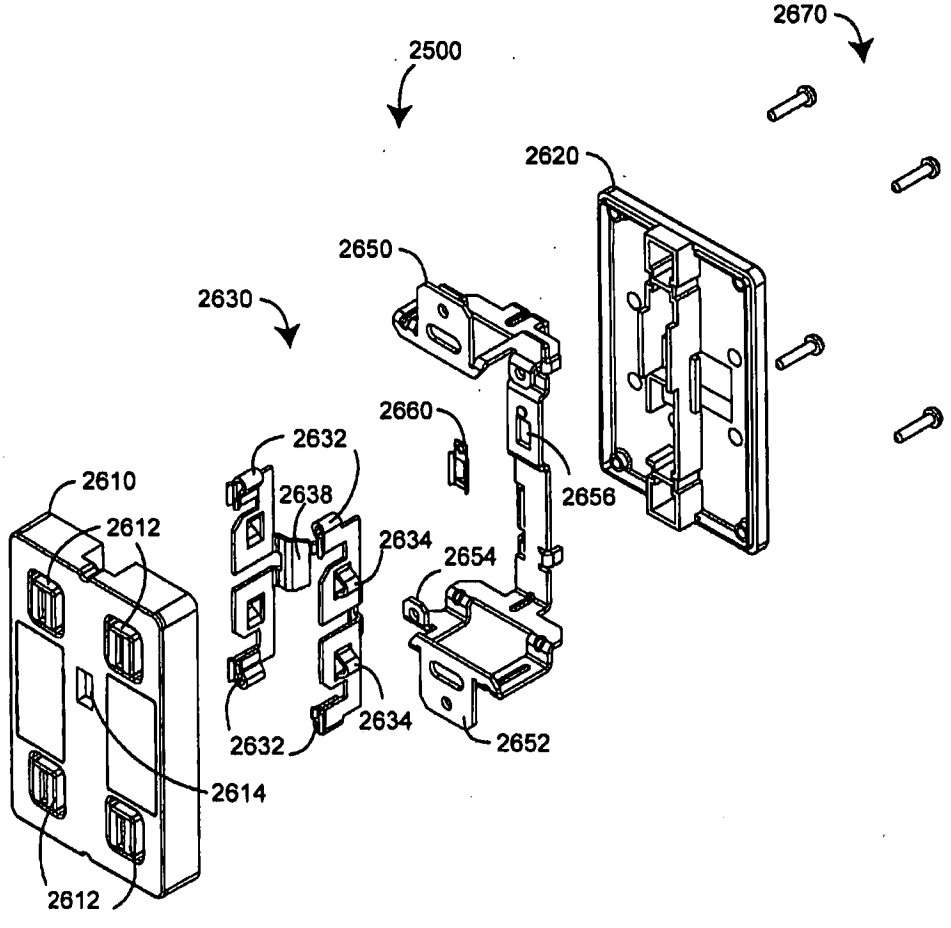
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FIG. 26A

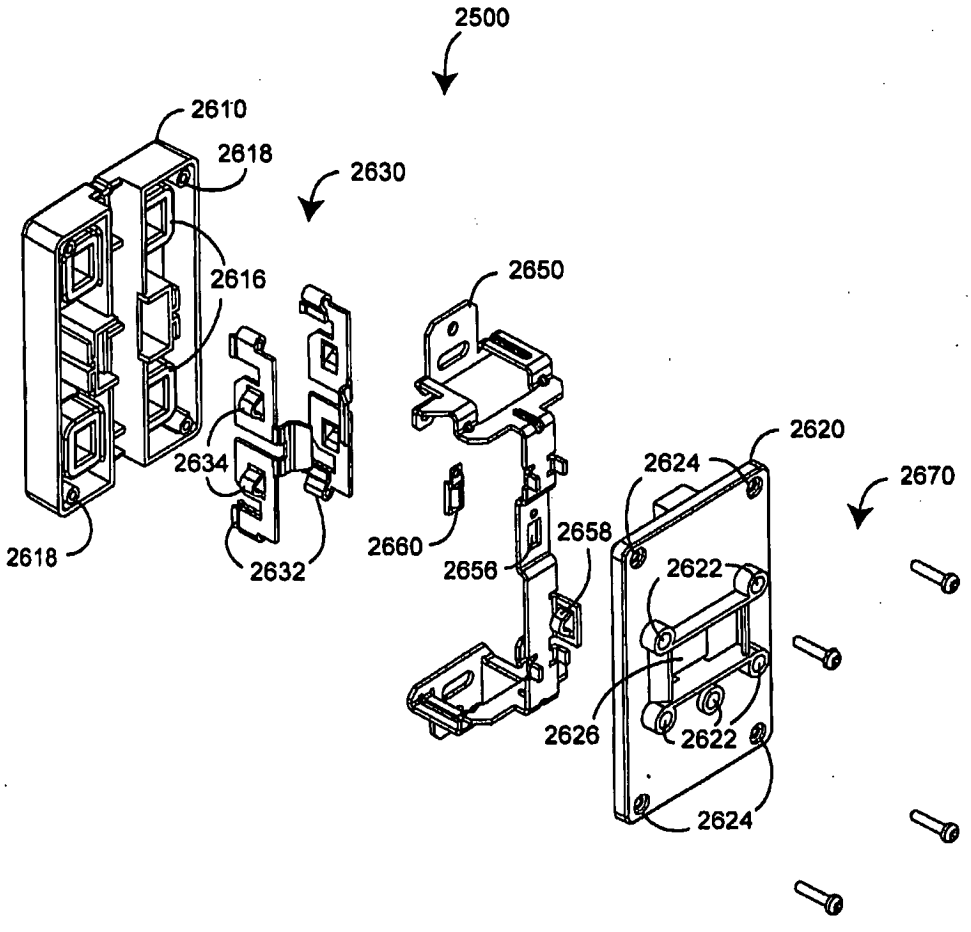
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FIG. 26B

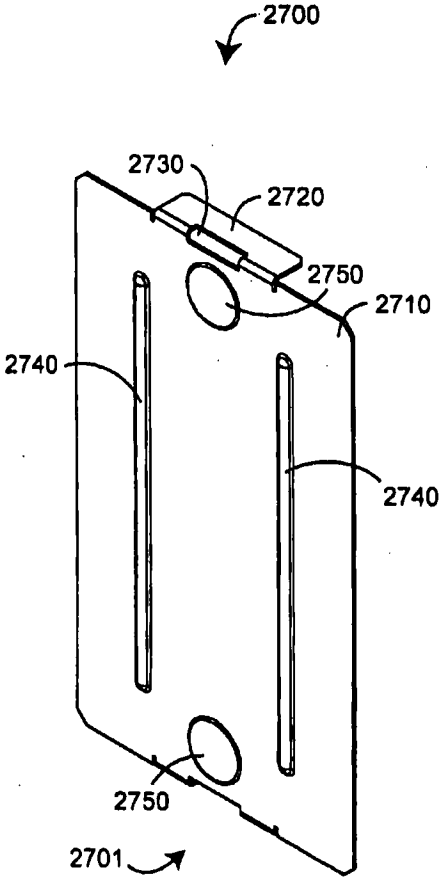

FIG. 27A

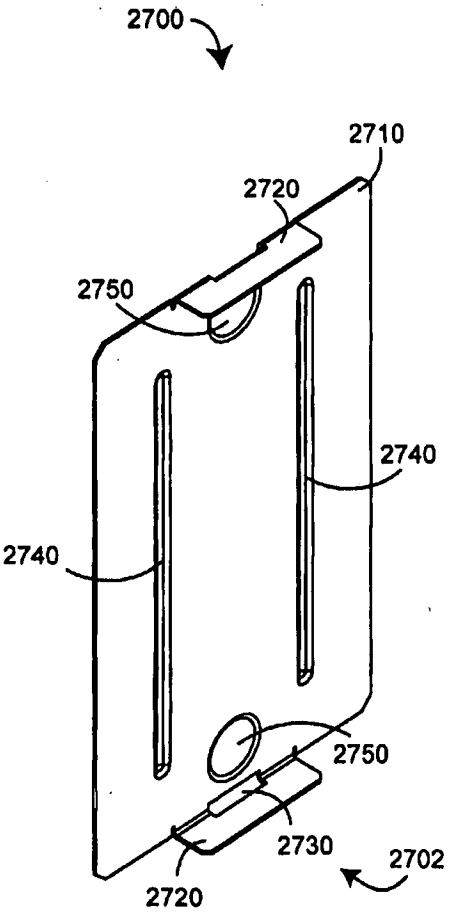

FIG. 27B

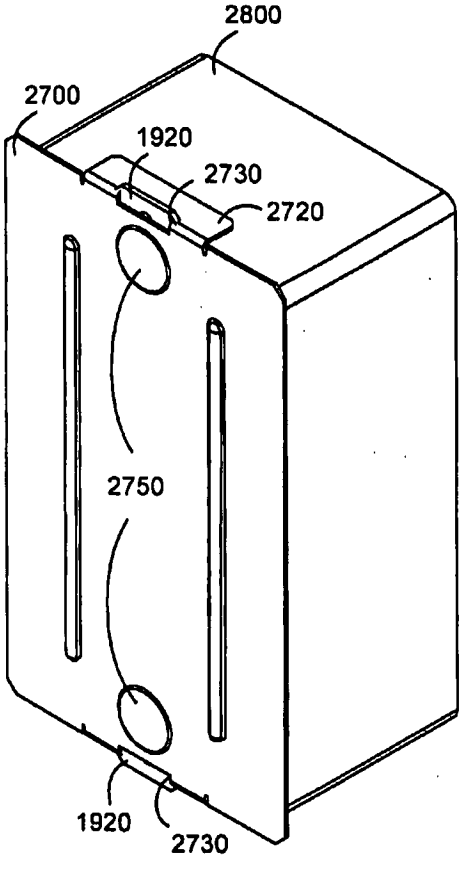

FIG. 28A

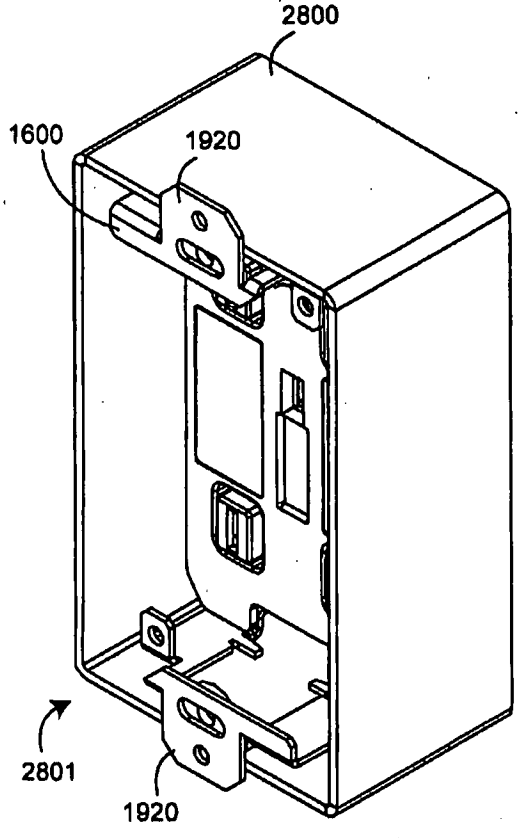

FIG. 28B

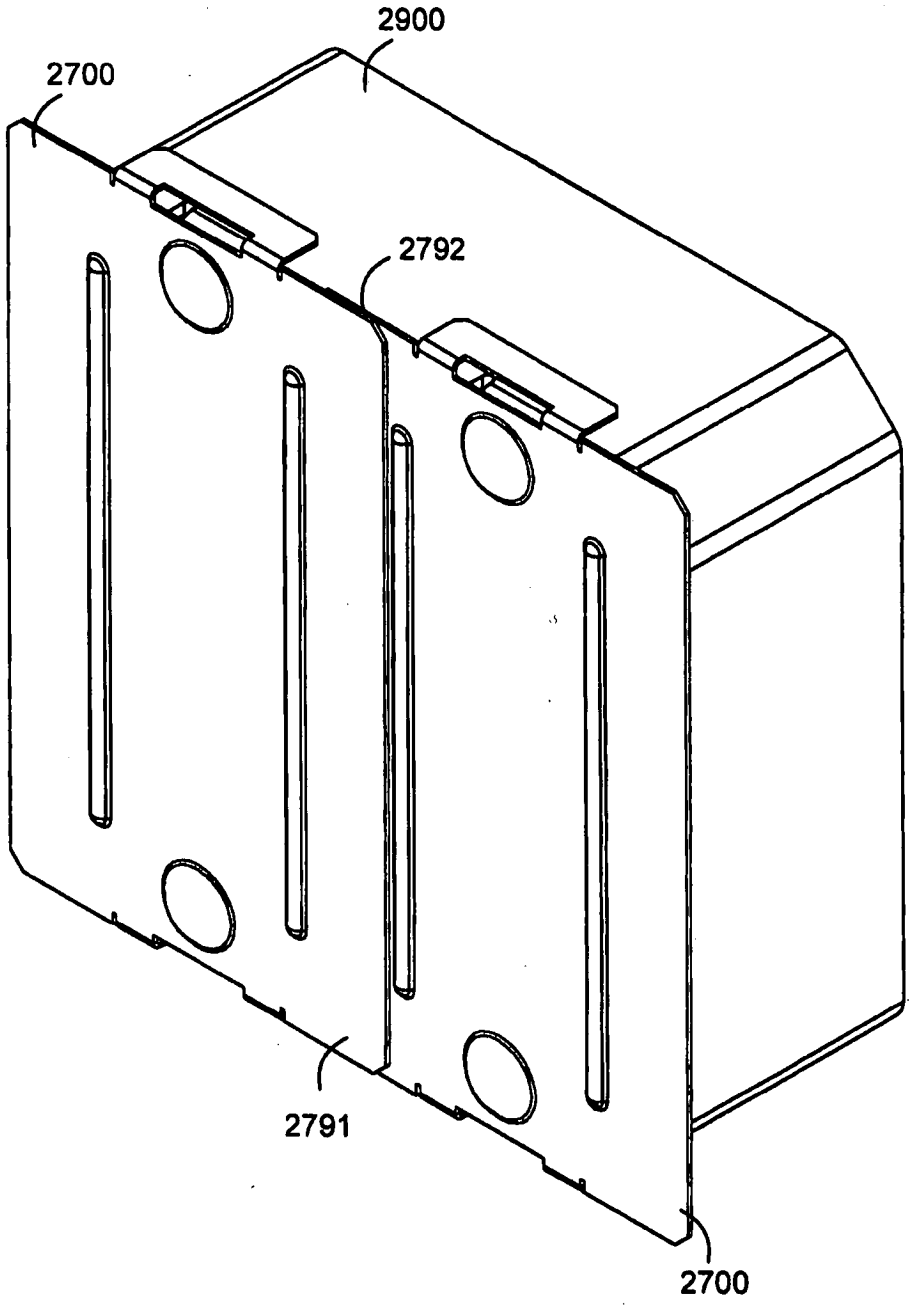

FIG. 29

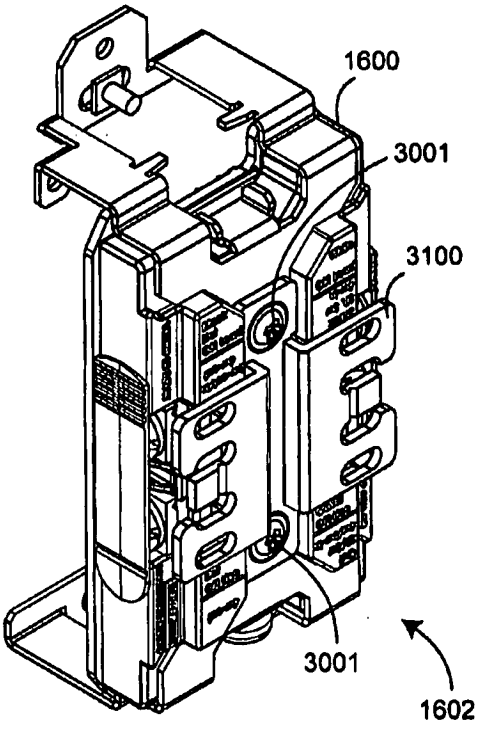

FIG. 30A

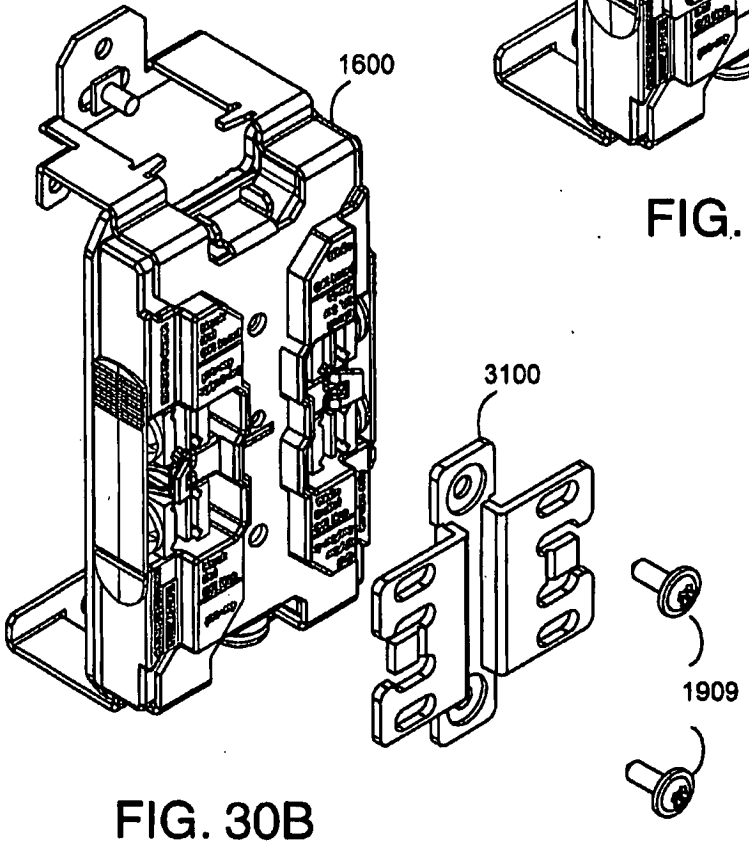

FIG. 30B

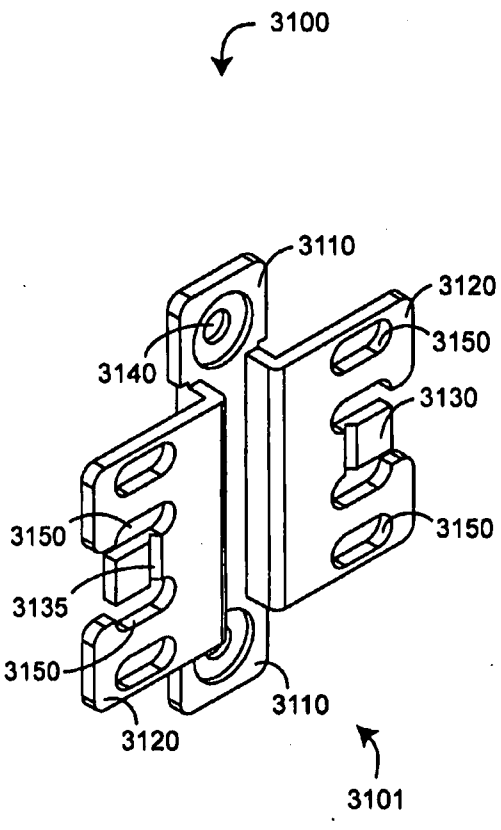

FIG. 31A

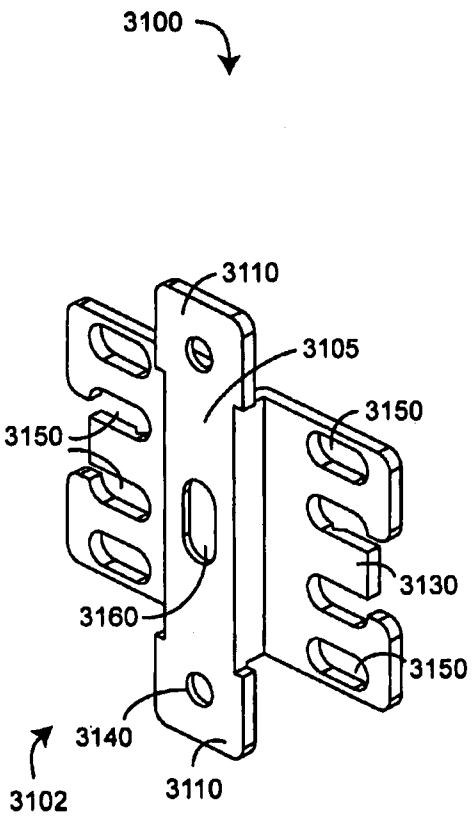

FIG. 31B

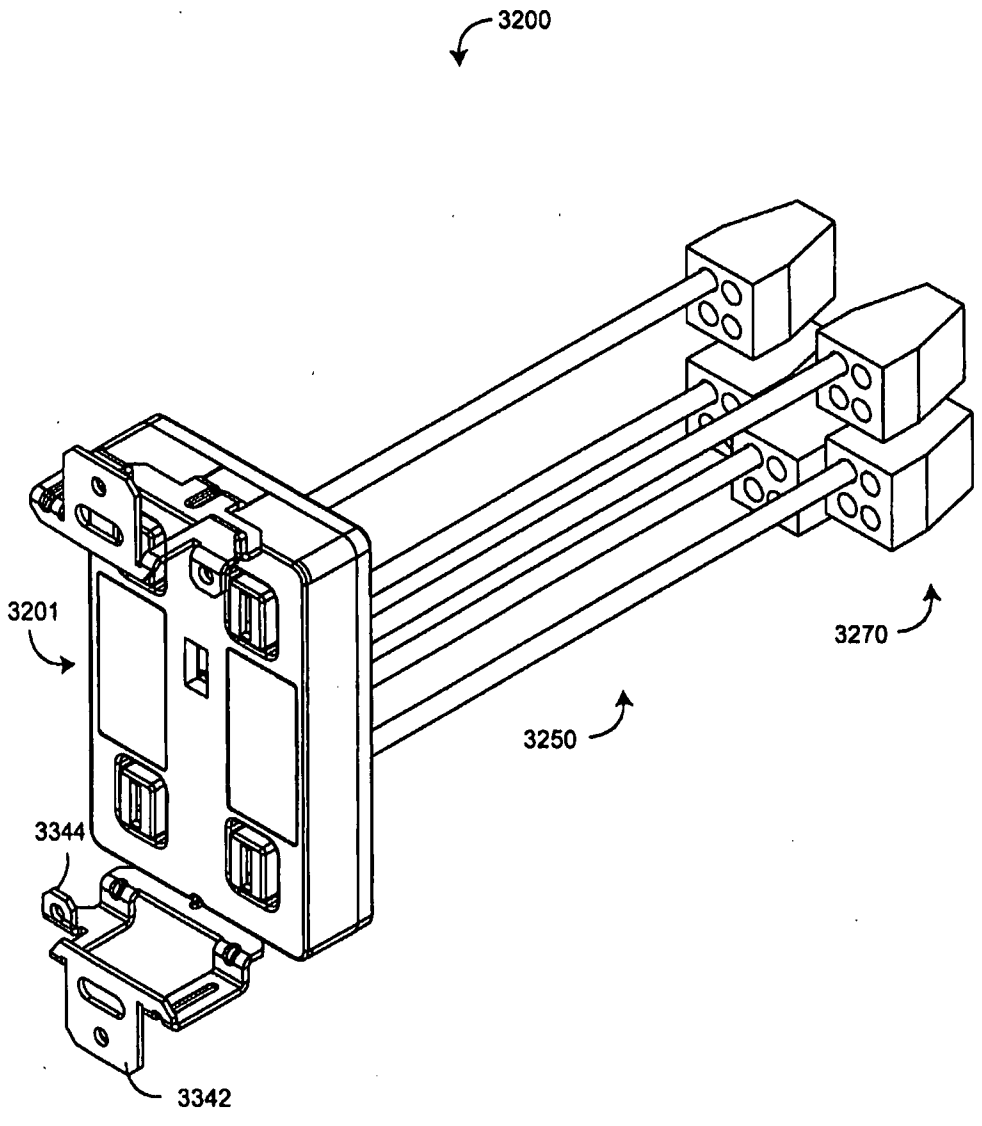

FIG. 32A

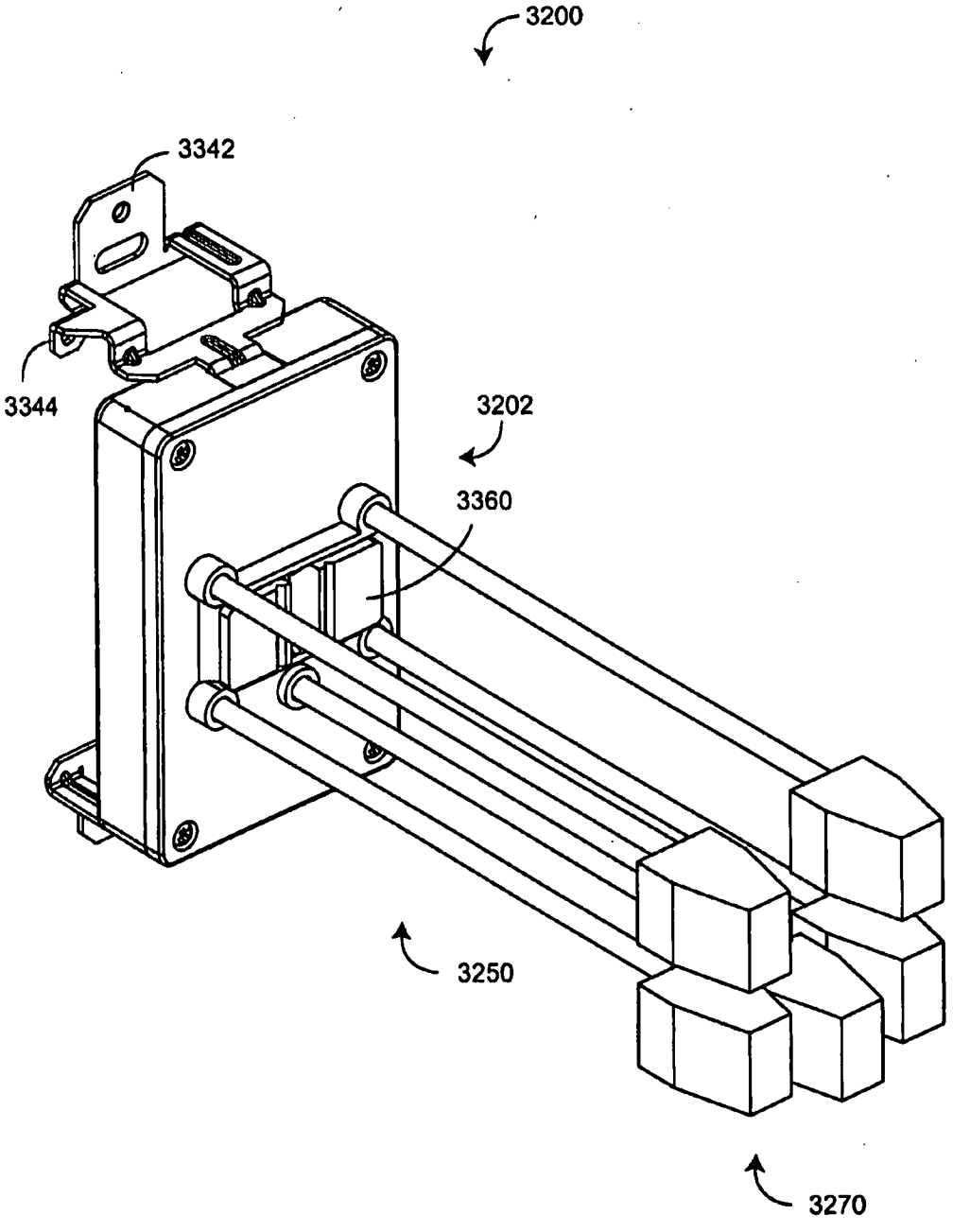

FIG. 32B

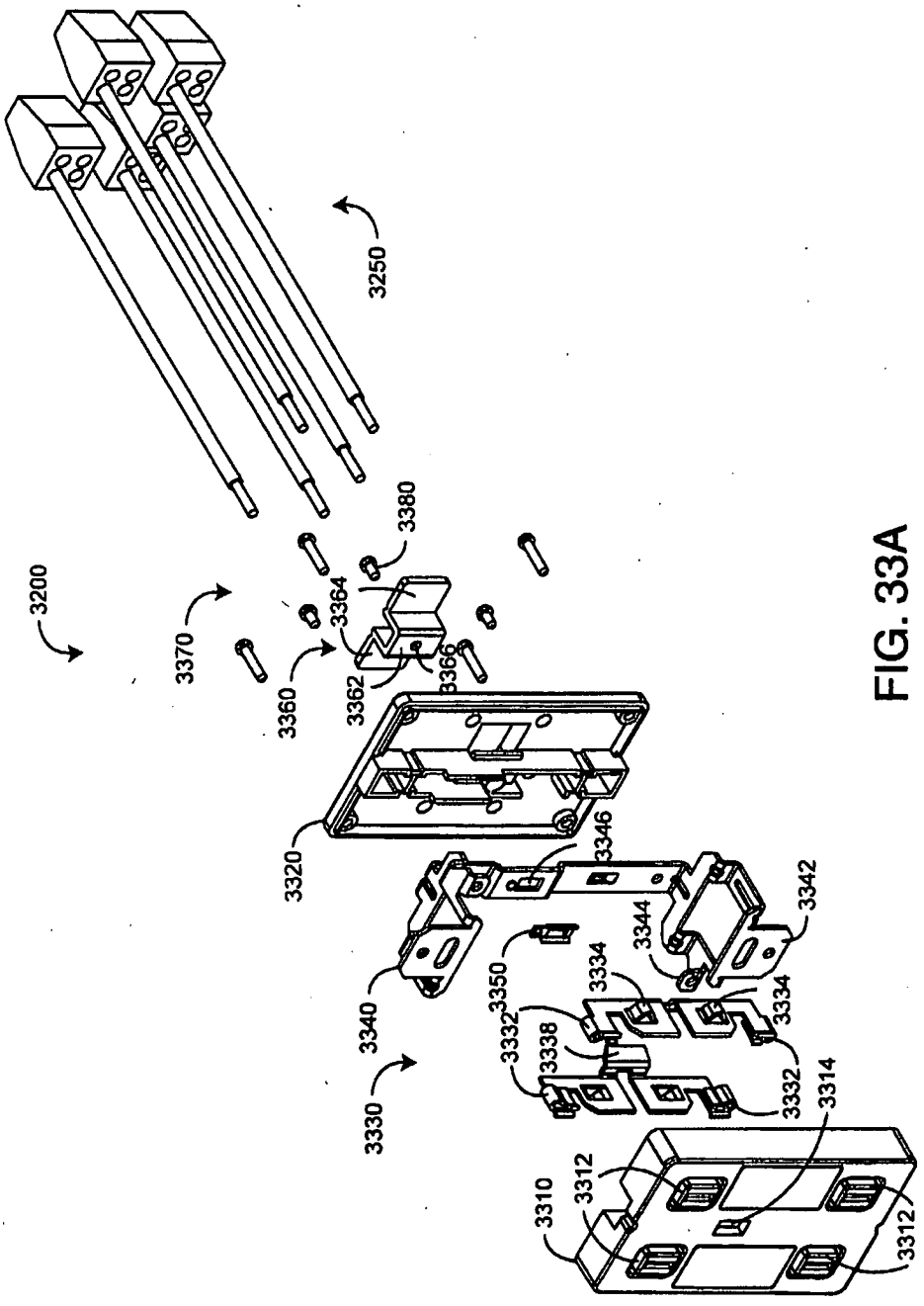
3250
3380
3200
3364
3370
3366
3360
3362
3320
3346
3342
3344
3340
3350
3334
3332
3338
3330
3314
3310
3312
3312

FIG. 33A

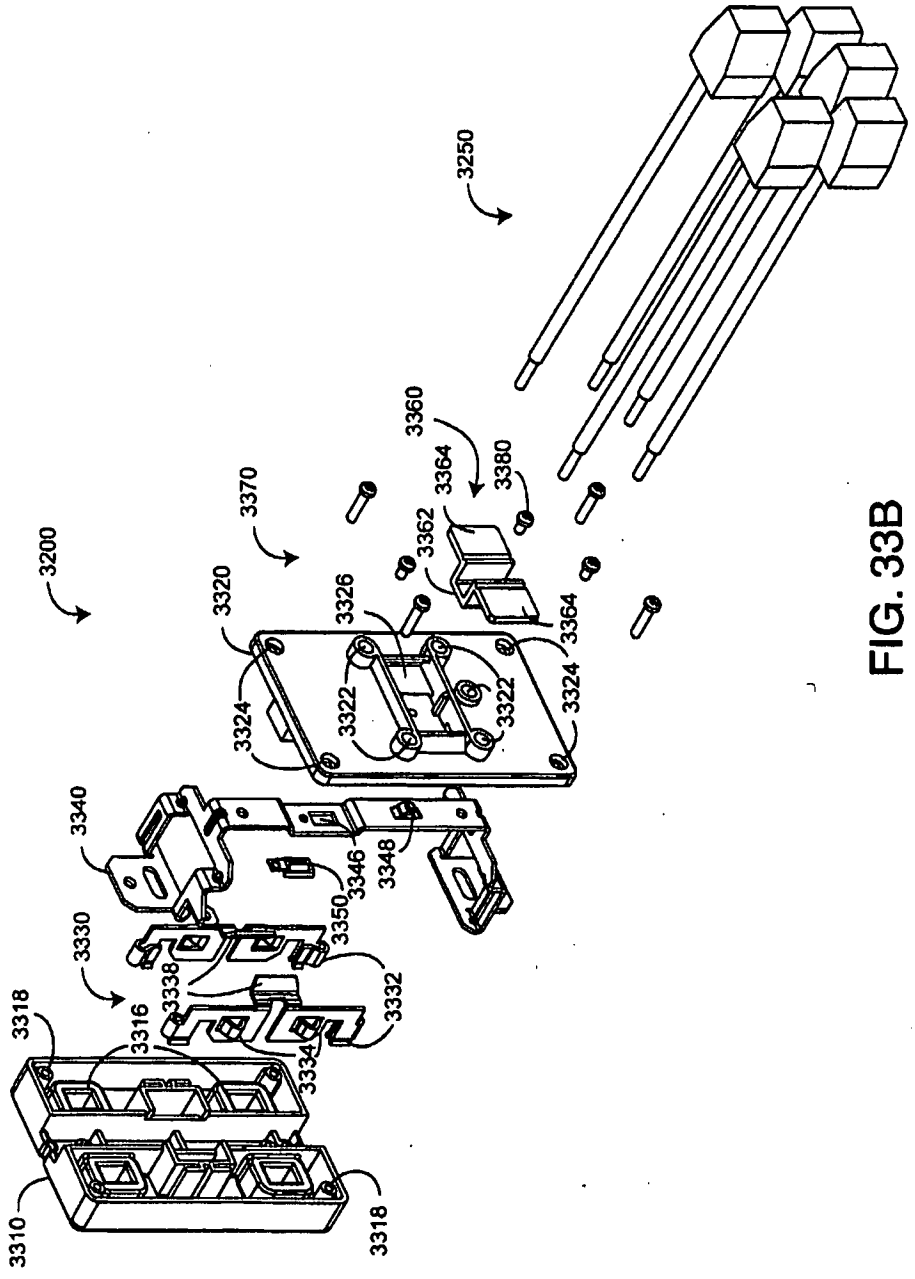
3250
3360
3364
3380
3370
3362
3200
3320
3326
3364
3324
3322
3322
3324
3340
3346
3348
3350
3330
3338
3332
3318
3316
3334
3310
3318

FIG. 33B

ELECTRICAL DISTRIBUTION WIRING MODULE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority benefit under 35 U.S.C. § 120 to and is a continuation of U.S. patent application Ser. No. 11/110,351 entitled Electrical Distribution Wiring Module, filed Apr. 20, 2005 now U.S. Pat. No. 7,052,313, which claims priority benefit under 35 U.S.C. § 119(e) to U.S. Provisional Application No. 60/631,244 entitled Sealed Wiring Module, filed Nov. 26, 2004. U.S. patent application Ser. No. 11/110,351 is a divisional of U.S. application Ser. No. 10/443,444 entitled Safety Module Electrical Distribution System filed May 22, 2003 now U.S. Pat. No. 6,884,111, which claims priority benefit under 35 U.S.C. § 119(e) from U.S. Provisional Application No. 60/383,269 entitled Safety Plug-In Module Electrical Distribution System, filed May 23, 2002, and U.S. Provisional Application No. 60/441,852 entitled Safety Module Electrical Distribution System, filed Jan. 21, 2003. All of the aforementioned prior applications incorporated by reference herein.

BACKGROUND OF THE INVENTION

Standard AC electrical systems are comprised of an electrical box and an electrical device, such as an outlet or switch, installed within the box. During a roughing phase of construction, electrical boxes are mounted to wall studs at predetermined locations. After the boxes are installed, a journeyman electrician routes power cables through building framing to the appropriate boxes. The power cable is fed through openings in the rear or sides of the electrical boxes and folded back into the boxes, unterminated, so as to be out of the way until the next phase. During a makeup phase, wall panels are installed and painted, and the journeyman returns to the construction site to install the electrical devices into the boxes. After conductors are wired to an electrical device, it and the attached conductors are pushed into the electrical box and the device is attached to the top and bottom of the box with screws. During a trim phase, face plates are mounted over the open-end of the electrical boxes, completing the standard electrical wiring process.

SUMMARY OF THE INVENTION

Standard AC electrical systems are problematic in construction and use, with respect to costs, safety and functionality. From an electrical contractor perspective, a journeyman electrician must make two separate trips to the job site, one for the rough phase and one for the makeup phase. Also, during the makeup phase, installation of the wall panels can damage the work completed during the rough phase. This occurs, for example, when a router contacts exposed cables as drywallers create a hole to accommodate electrical box openings. Another form of damage occurs when drywall compound or paint fouls the exposed cables, insulation and labeling.

From a general contractor's perspective, verification of the electrical contractor's work is not possible until after the makeup phase. Until then, the electrical cables are unterminated. After the makeup phase, however, miswiring typically requires cutouts in the installed wall panels and associated patches after corrections are completed. Further, the electrical system cannot be activated until after verification. Thus,

during the rough and makeup phases, electricity for tools and lighting must be supplied by generators, which create hazards due to fumes, fuel, and noise and are an unreliable electrical source. In addition, until the trim phase is completed, unskilled personnel have access to the electrical cable. Tampering can compromise the integrity of the electrical wiring and also create a safety problem after power is activated.

From a homeowner's perspective, there are problems with repair of the standard electrical wiring. Replacement of a broken outlet or switch device first requires removal of a face plate. The screws that attach the module to the top and bottom of the electrical box must be removed next. The device is then removed from the box and the conductors are removed by loosing the screws on the outlet sides. The process is then reversed to attach the conductors to a new device and mount the new device into the electrical box.

The prior art electrical device replacement procedure described above exposes the homeowner to AC wiring upon removal of the face plate. This exposure creates a shock hazard. Further, a homeowner's reluctance to change out broken devices or to spend the money to hire an electrician also creates a shock and a fire hazard from continued use of cracked, broken or excessively worn outlets or switches. In addition, the integrity of the original wiring becomes questionable if a homeowner or other third party removes and replaces an electrical device. Miswiring by a third party can violate building codes and create shock and fire hazards, such as inadvertently switching the hot and neutral conductors, failing to attach ground wires, kinking or nicking conductors or improperly tightening connections.

An electrical distribution wiring module benefits the electrical contractor in several respects. The wiring module is installed internally to an electrical box and associated functional modules are removably installed into the wiring module without exposure to or access to electrical system wiring attached behind the panel. The journeyman's work can complete at the rough phase, when installation of the wiring module is complete. Thus, there is no need for the journeyman to return to the job site during the makeup phase because any semi-skilled laborer can insert, for example, an appropriate outlet or switch module. Further, there is no wiring access after the rough phase, protecting wiring integrity. Also, there are no exposed conductors or parts inside the electrical box that can be inadvertently damaged during wall panel installation.

An electrical distribution wiring module also benefits the general contractor. Because wiring is completed during rough framing, verification and activation of the building electrical system can be performed at the rough phase. Miswiring can be corrected before wall panels are installed and painted, eliminating cut and patch repairs. Early electrical system activation eliminates the need to use generators. Lack of third party access to the journeyman's wiring preserves integrity after verification and eliminates shock exposure to other workers.

An electrical distribution wiring module also benefits the homeowner. Replacement of broken sockets and switches can be easily and safely accomplished. Safety is enhanced by reducing exposure to electrical wiring and encouraging replacement of defective outlets and switches. Further, maintenance costs are reduced by reducing the need to hire an electrician for repairs. Wiring integrity is insured by reducing the opportunity of unqualified third parties to access the electrical system.

One aspect of an electrical distribution system is a wiring module installed within an electrical box, wherein the wiring

module is configured to connect to a power cable routed to the electrical box. The wiring module distributes electrical power according to a functional module that is pluggable into the wiring module. A cover is removably mounted to the wiring module so that the cover extends generally flush over an open face of the electrical box. The cover prevents plaster and other material from fouling the wiring module during wall panel installation and is removed after wall panel installation so as to plug the functional module into the wiring module.

In an embodiment, a mounting bracket extends from the wiring module. Box mounts are disposed on opposite portions of the mounting bracket. The box mounts attach to the electrical box proximate the electrical box open face so as to secure the wiring module within the electrical box. Cover mounts are disposed generally centered proximate opposite edges of the cover. The cover mounts attach to the box mounts so as to secure the cover over the electrical box open face.

Another aspect of an electrical distribution system is a wiring module having a functional side, an opposite wiring side and a mounting bracket. A cover is removably mounted to the wiring module. The wiring module is configured to mount within an electrical box so as to connect the wiring side to a power cable routed to the electrical box. The mounting bracket has box mounts configured to secure the mounting bracket to the electrical box. The cover is disposed generally flush with an open face of the electrical box when the wiring module is mounted within the electrical box so that the cover prevents plaster and other material from fouling the wiring module during wall panel installation. The cover is removed to expose the wiring module functional side after wall panel installation so as to allow a functional module to plug into sockets disposed on the wiring module functional side.

In an embodiment, the cover has a generally planar cover plate, cover mounts and apertures. The cover plate has an area extending substantially across the electrical box open face. The cover mounts are generally centered proximate a top edge and proximate a bottom edge of the cover plate. The apertures are defined on the cover mounts for securing the cover plate to the wiring module box mounts.

A further aspect of an electrical distribution system is an electrical box having an open face and configured to route a power cable in communications with electrical power. A wiring module is installed within the electrical box and configured to connect to the power cable, mount a functional module, and distribute electrical power according to the functional module. A mounting bracket extends from the wiring module and is configured to mount the wiring module within the electrical box. Box mounts disposed on the mounting bracket secure the wiring module to the electrical box. A cover plate is removably mounted to the wiring module mounting bracket and is disposed generally flush to the electrical box open face so as to prevent foreign material from entering the electrical box during wall construction.

In an embodiment, cover mounts are generally centered proximate a top edge and proximate a bottom edge of the cover plate. Apertures are defined on the cover mounts for securing the cover plate to the wiring module box mounts. In a multi-gang box embodiment, a second cover plate is removably mounted to a second wiring module and disposed generally flush to the open face of a multi-gang electrical box. Portions of the cover plate and second cover plate overlap so as to prevent foreign material from entering the multi-gang box between the cover plates.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A–B are perspective views of an outlet module installed and removed, respectively, from a corresponding wiring module;

FIGS. **2**A–B are perspective views of a switch module installed and removed, respectively, from a corresponding wiring module;

FIGS. **3**–**8** are perspective views of an outlet module and outlet module components;

FIGS. **3**A–B are front and back perspective views, respectively, of an outlet module;

FIGS. **4**A–B are exploded, front perspective views of outlet modules;

FIGS. **5**A–B are front and back perspective views, respectively, of an outlet module front cover;

FIGS. **6**A–B are front and back perspective views, respectively, of an outlet module back cover;

FIGS. **7**A–B are front and back perspective views, respectively, of an outlet module power contact set;

FIGS. **8**A–B are front and back perspective views, respectively, of an outlet module ground contact set;

FIGS. **9**–**15** are perspective views of a switch module and switch module components;

FIGS. **9**A–B are front and back perspective views, respectively, of a switch module;

FIG. **10** is an exploded, front perspective view of a switch module;

FIGS. **11**A–B are front and back perspective views, respectively, of a switch module switch;

FIGS. **12**A–B are front and back perspective views, respectively, of a switch module front cover;

FIGS. **13**A–B are front and back perspective views, respectively, of a switch module single-pole, single throw (SPST) contact set;

FIGS. **13**C–D are front and back perspective views, respectively, of a switch module single-pole, double throw (SPDT) contact set;

FIGS. **13**E–F are front and back perspective views, respectively, of a switch module double-pole, double throw (DPDT) contact set;

FIGS. **14**A–B are front and back perspective views, respectively, of a switch module actuator;

FIGS. **15**A–B are front and back perspective views, respectively, of a switch module back cover;

FIGS. **16**–**22** are perspective views of a wiring module and wiring module components;

FIGS. **16**A–B are front and back perspective views, respectively, of a terminal-block wiring module;

FIGS. **16**C–D are back perspective views of a terminal-block wiring module and associated terminal guards in open positions;

FIGS. **16**E–F are front and back views, respectively, of a terminal-block wiring module and position-dependent wiring labels;

FIGS. **16**G–H are switch and outlet wiring schematics, respectively;

FIGS. **17**A–B are exploded, front perspective views of a terminal-block wiring module with stationary-mount and swivel-mount terminal guards, respectively;

FIGS. **18**A–B are front and back perspective views and a back view, respectively, of a wiring panel;

FIGS. **19**A–B are front and back perspective views, respectively, of a mounting bracket;

FIGS. **20**A–B are front and back perspective views, respectively, of a wiring panel front cover;

FIGS. **21** is a perspective view of a wiring panel terminal set;

FIGS. **22**A–B are front and back perspective views, respectively, of a wiring panel back cover;

FIGS. **23**A–B are front and back perspective views, respectively, of a dimmer switch module;

FIG. **24** is an exploded, front perspective view of a dimmer switch module;

FIGS. **25**A–B are front and back perspective views, respectively, of a fixed-wire wiring module;

FIGS. **26**A–B are exploded, front and back perspective views, respectively, of a fixed-wire wiring module;

FIGS. **27**A–B are front and back perspective views, respectively, of an electrical box cover;

FIGS. **28**A–B are front perspective views of a covered and uncovered electrical box, respectively;

FIG. **29** is a front perspective view of a 2-gang electrical box with overlapping covers;

FIGS. **30**A–B are back perspective and back perspective exploded views, respectively, of a wiring module having a terminal shield; and

FIGS. **31**A–B are front and back perspective views, respectively, of a terminal shield;

FIGS. **32**A–B are front and back perspective views, respectively, of a sealed wire wiring module; and

FIGS. **33**A–B are exploded front and back perspective views, respectively, of a sealed wire wiring module.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

System Overview

FIGS. **1–2** illustrate a safety module electrical distribution system **100** having a functional module **110** and a wiring module **1600**. The electrical distribution system **100** is configured to mount within a standard electrical box (not shown), such as is typically installed within a building wall. In particular, the wiring module **1600** is configured to be easily installed within an electrical box, and a functional module **110** is configured to be removably plugged into the wiring module **1600**, as described below. FIGS. **1**A–B show an outlet module **300** in an installed and a removed position, respectively. FIGS. **2**A–B show a switch module **900** in an installed and a removed position, respectively. A face plate (not shown) may be installed over a functional module **110** so as to provide an aesthetic trim.

As shown in FIGS. **1–2**, each functional module **110** provides a user-accessible electrical distribution function. As shown in FIGS. **1**A–B, the functional module **110** may be an outlet module **300**, which functions to supply a user with electrical power through a conventional AC plug inserted into one of the module sockets. The outlet module **300** is configured for installation in a ground-up position in a wiring module **1600** oriented for outlet installation. Alternatively, an outlet module and wiring module can be configured for outlet installation in a ground-down position.

As shown in FIGS. **2**A–B, the functional module **110** may be a switch module **900**, which allows a user to control electrical power to an outlet, a light or any of various electrical devices (not shown) by actuating the module switch. The switch is slideable between first and second positions in contrast to a conventional toggle switch, such as used for turning an interior light on and off. The switch module **900** is configured for installation in a wiring module **1600** oriented for switch installation. Reversible wiring module **1600** orientation within an electrical box to indicate the module to be installed and its proper orientation is described in detail with respect to FIGS. **16**A–H, below

Other outlet and switch related functional modules **110** may include GFCI outlets, covered safety outlets and dimmer switches (FIGS. **23–24**) to name just a few. Further, the electrical distribution system **100** may be wall-mounted, ceiling-mounted or floor-mounted. In additional, the electrical distribution system **100** can be adapted for uses other than building electrical distribution, such as airplane, automobile or boat electrical distribution applications, to name a few. A modular electrical outlet and switch system is described in U.S. Pat. No. 6,341,981 entitled Safety Electrical Outlet and Switch System, and a covered safety outlet module is described in U.S. patent application Ser. No. 10/737,713 entitled Safety Outlet Module, both assigned to ProtectConnect, Irvine, Calif. and incorporated by reference herein.

Outlet Module

FIGS. **3**A–B illustrate an outlet module **300** having a body **310**, a front side **301** and a back side **302**. The body **310** accepts attachment screws **305** on diagonally opposite corners that are utilized to secure the outlet module **300** to a wiring module **1600** (FIGS. **1**A–B). The outlet module front side **301** provides upper and lower sockets **320** each configured to accept a conventional, three-wire (grounded) electrical plug. The outlet module back side **302** provides shielded plugs **330** and a ground bar **834** that physically and electrically connect the outlet module **300** to a wiring module **1600** (FIGS. **1**A–B). The shielded plugs **330** transfer electrical power to the sockets **320**, and the ground bar **834** provides a ground path for the sockets **320**. The ground bar **834** also functions as a key to assist in orienting the outlet module **300** relative to the wiring module **1600** (FIGS. **1**A–B).

FIG. **4**A illustrates an outlet module **300** having a front cover **500**, a rear cover **600**, a power contact set **700** and a ground contact set **800**. The front cover **500** and back cover **600** form the outlet module body **310** (FIGS. **3**A–B). The covers **500**, **600** advantageously snap together with a latch and catch assembly, described with respect to FIGS. **5–6**, below. This reduces manufacturing assembly steps and reduces or eliminates the need for separate fasteners, such as rivets or screws and/or sonic welding. The contact set **700**, **800** is retained within the covers **500**, **600** and provides conductive paths from the wiring panel **1600** (FIGS. **16**A–B) to the outlet sockets **320** (FIG. **3**A). In particular, a power contact set **700** transfers power from the shielded plugs **330** (FIG. **3**B) to the outlet sockets **320** (FIG. **3**A). A ground contact set **800** provides a ground path between a ground bar **834** (FIG. **3**B) and the outlet sockets **320** (FIG. **3**A). The ground contact set components **810**, **830**, **850** are assembled as described with respect to FIGS. **8**A–B, below. In one embodiment, the covers **500**, **600** are constructed of nylon. FIG. **4**B illustrates an alternative embodiment of an outlet module **400**, such as for 20A applications

FIGS. **5**A–B illustrate the outlet module front cover **500** having an outside face **501**, an inside face **502**, outlet apertures **510**, attachment ears **520**, side latches **530** and contact housing structure **540**, **550**. As shown in FIG. **5**A on the outside face **501**, the outlet apertures **510** form the entry to the outlet module sockets **320** (FIG. **3**A) and include a hot slot, neutral slot and ground hole for each of a top socket and bottom socket. The attachment ears **520** are advantageously integral to the front cover **500**, eliminating the need for a separate mechanism for attaching the outlet module **300** (FIGS. **3**A–B) to the wiring module **1600** (FIGS. **16**A–B).

The attachment ears **520** are located at an upper right corner and a diagonally opposite lower left corner (not visible), and each has a fastening aperture that accepts, for example, an attachment screw **305** (FIGS. **3**A–B). The side latches **530** form the front cover portion of the latch and catch assembly, functionally described with respect to FIG. **4**, above.

As shown in FIG. **5**B on the inside face **502**, a power contact structure **540** accepts the power contact set **700** (FIGS. **7**A–B) so that the power contact clips **701** (FIGS. **7**A–B) align with the hot and neutral slots of the outlet apertures **510**. A ground contact structure **550** accepts the ground contact set **800** (FIGS. **8**A–B) so that the ground contact clips **832**, **852** (FIGS. **8**A–B) align with the ground holes of the outlet apertures **510**.

FIGS. **6**A–B illustrate the outlet module back cover **600** having an outside face **601**, an inside face **602**, plug shields **610**, a ground bar aperture **620**, side catches **630** and contact support structure **640**, **650**. As shown in FIG. **6**B on the outside face **601**, the plug shields **610** advantageously provide the shield portion of the shielded plugs **330** (FIG. **3**B). Specifically, the plug shields **610** completely surround all sides of the power contact set prongs **702** (FIGS. **7**A–B). In this manner, the prongs. **702** (FIGS. **7**A–B) are not exposed when the outlet module-plugs **330** (FIG. **3**B) are engaged with the wiring module sockets **810** (FIG. **18**A), even when the outlet module **300** (FIGS. **3**A–B) is partially separated from the wiring module **1600** (FIGS. **16**A–B). The ground bar aperture **620** allows the ground bar **834** (FIGS. **8**A–B) to protrude through the back cover **600**, providing a ground contact with the wiring module **1600** (FIGS. **16**A–B). The side catches **630** provide apertures that accept and engage the side latches **530** (FIGS. **5**A–B) so as to releaseably secure together the front cover **500** (FIGS. **5**A–B) and the back cover **600**.

As shown in FIG. **6**A on the inside face **602**, a power contact support structure **640** consists of slots that allow the prongs **702** (FIGS. **7**A–B) to protrude through the back cover **600** within the plug shields **610**, providing a power connection with the wiring module **1600** (FIGS. **16**A–B). A ground contact support structure **650** supports the ground contact set **800** (FIGS. **8**A–B).

FIGS. **7**A–B illustrate the power contact set **700** having an upper hot contact **710**, a lower hot contact **720**, an upper neutral contact **730** and a lower neutral contact **740**. Each contact **710**–**740** has a prong clip **701** interconnected with a prong **702**. The prong clips **701** align with the front cover hot and neutral slots **510** (FIG. **5**A) to form the outlet module sockets **320** (FIG. **3**A). The prongs **702** insert through the power contact support structure **640** into the plug shields **610** to form the outlet module shielded plugs **330** (FIG. **3**B). Advantageously, the power contact set **700** is configured so that the contacts may be manufactured by a stamp and fold process. In one embodiment, the contacts are brass.

FIGS. **8**A–B illustrate a ground contact set **800** having a ground buss **810**, an upper ground contact **830** and a lower ground contact **850**. The ground clips **832**, **852** align with the front cover ground holes **510** (FIG. **5**A) to form the ground portion of the outlet module sockets **320** (FIG. **3**A). The ground bar **834** protrudes through the back cover **600** (FIGS. **6**A–B) to provide a ground path connection with the wiring module **1600** (FIGS. **16**A–B). The unassembled ground contact set **800** is illustrated in FIG. **4**, above. Ground contact set **800** assembly is described below.

As shown in FIGS. **8**A–B, the ground buss **810** has a upper rivet **812**, a lower rivet **814**, a upper cutout **815**, a slot **816** and a lower cutout **818**. The ground buss **810** mechanically supports and electrically interconnects the upper ground contact **830** and the lower ground contact **850**. The upper ground contact **830** has an upper ground clip **832**, a ground bar **834**, leaves **836** and a tab **838**. The upper ground clip **832** and ground bar **834** extend from opposite ends of the upper ground contact **830**. The upper ground clip **832** accepts a ground pin from a standard AC electrical plug. The ground bar **834** inserts into a corresponding ground clip **1902** (FIGS. **19**A–B) in the wiring module **1600** (FIGS. **16**A–B). The tab **838** extends generally perpendicularly below and between the clip **832** and bar **834** and has an aperture corresponding to the top rivet **812**. The leaves **836** extend from the back of the clip **832**. The lower ground contact **850** has a lower ground clip **852**, leaves **854** and a tab **858**. The tab **858** extends generally perpendicularly to the clip **852** and has an aperture corresponding to the lower rivet **814**. The leaves **854** extend from the back of the clip **852**.

Also shown in FIGS. **8**A–B, the ground contact set **800** is assembled by inserting the upper ground contact **830** and lower ground contact **850** into the ground buss **810**. Specifically, the ground bar **834** is inserted into the slot **816**, the leaves **836**, **854** are inserted into the upper and lower cutouts **815**, **818**, respectively, the upper and lower rivets **812**, **814** are inserted through the tabs **838**, **858**. The rivets **812**, **814** are then splayed, fixedly attaching the upper and lower ground contacts **830**, **850** to the ground buss **810**. Advantageously, the ground contact set **800** is configured so that the ground contact set components **810**, **830**, **850** may be manufactured by a stamp and fold process. In one embodiment, the upper and lower ground contacts **830**, **850** are brass and the ground buss **810** is zinc-plated steel.

Switch Module

FIGS. **9**A–B illustrate a switch module **900** having a body **910**, a front side **901** and a back side **902**. Like the outlet module body **310** (FIGS. **3**A–B), the switch module body **910** accepts screws on diagonally opposite corners that are utilized to secure the switch module **900** to a wiring module **1600** (FIGS. **2**A–B). The switch module front side **901** has a slideable switch **1100** configured to actuate internal contacts so as to route electrical power, to turn on and off a light, for example. Like the outlet module **300** (FIGS. **3**A–B), the switch module back side **902** provides shielded plugs **930** that physically and electrically connect the switch module **900** to a wiring module **1600** (FIGS. **2**A–B). The shielded plugs **930** conduct electrical power under control of the switch **1100**. There may be null plugs **940** having no conductors depending on the switch module **900** configuration and associated function, as described with respect to FIGS. **13**A–F, below. The switch module **900** does not require a ground path to the wiring module **1600** (FIGS. **2**A–B). A key bar **1520**, therefore, provides a non-conducting structure that substitutes for a ground bar **834** (FIG. **3**B), to assist in orienting the switch module **900** relative to the wiring module **1600** (FIGS. **2**A–B).

FIG. **10** illustrates a switch module **900** having a switch **1100**, a front cover **1200**, a rear cover **1500**, a contact set **1300**, an actuator **1400** and a spring **1000**. The front cover **1200** and back cover **1500** form the switch module body **910** (FIGS. **9**A–B). The covers **1200**, **1500** advantageously snap together and are secured with a latch and catch assembly, described with respect to FIGS. **12**A–B and **15**A–B, below. This reduces manufacturing assembly steps and reduces or eliminates the need for separate fasteners, such as rivets or screws and/or sonic welding. In one embodiment, the covers **1200**, **1500** are constructed of nylon.

As shown in FIG. **10**, the switch **1100** snaps into and is slidably retained by the front cover **1200** and engages the actuator **1400**. The switch **1100** is movable between a first position and a second position. The contact set **1300**, actuator **1400** and spring **1000** are retained within the covers **1200**, **1500**. The contact set **1300** routes electrical power from the wiring panel **1600** (FIGS. 1A–B) as determined by the switch **1100** positions. In particular, the position of the switch **1100** determines the position of the actuator **1400**, which, in turn, determines whether the contact set **1300** is open or closed. If closed, the contact set **1300** provides a conductive path that transfers power between the shielded plugs **930** (FIG. 3B). The switch **1100** remains in its manually set position under tension from the spring **1000**.

FIGS. **11**A–B illustrate a switch **1100** that is generally rectangular, having a front side **1101** and a back side **1102**. The front side **1101** has a finger grip **1110** for manually sliding the switch between its first position and its second position, as described above. The back side **1102** has latches **1120** and a lever **1130** that extends in a direction generally normal to the plane of the back side **1102**. The latches **1120** are configured to pass through front cover slots **1214** (FIG. **12**A), which cause the latches **1120** to flex inward toward the extension **1130** as the switch **1100** is pressed into the front cover **1200** (FIGS. **12**A–B). The latches **1120** spring outward after the latches pass through the slots **1214** (FIG. **12**A), seating the switch in the front cover **1200** (FIGS. **12**A–B), as described below. The lever tip **1132** inserts through the actuator slot **1410** (FIGS. **14**A–B) and contacts the spring **1000**, mechanically connecting the switch **1100** to the actuator **1400** (FIGS. **14**A–B).

FIGS. **12**A–B illustrate a front cover **1200** having an outside face **1201**, an inside face **1202**, a switch cavity **1210**, attachment ears **1220**, side latches **1230** and top and bottom catches **1240**. Located on the outside face **1201**, the cavity **1210** is configured to accommodate the switch **1100** (FIGS. **11**A–B). Within the cavity **1210** is a lever slot **1212** that allows the switch lever **1130** (FIG. **11**B) to pass through the front cover to the actuator **1400** (FIGS. **14**A–B). The lever slot **1212** extends along the cavity **1210** a sufficient distance to allow switch movement between first and second positions, as described above. Also within the cavity **1210** are catch slots **1214** that accommodate and capture the switch latches **1120** (FIG. **11**B), as described above. The attachment ears **1220** are located at an upper right corner and a diagonally opposite lower left corner (not visible), and each has a fastening aperture that accepts, for example, an attachment screw **305** (FIGS. **3**A–B). The side latches **1230** and top and bottom catches **1240** form the front cover portion of the latch and catch assembly, functionally described with respect to FIG. **10**, above.

FIGS. **13**A–B illustrate a SPST contact set **1300** having a throw buss **1310** and a pole buss **1320**. The throw buss **1310** has a first prong **1312**, a flexible throw **1314** and a throw contact **1318**. The pole buss **1320** has a second prong **1322**, a fixed pole **1324** and a pole contact **1328**. The first and second prongs **1312**, **1322** form the conductive portion of the shielded plugs **930** (FIG. **9**B). The flexible throw **1314** engages the actuator **1400**, as described with respect to FIGS. **14**A–B, below, which moves the throw between an open position and a closed position (shown). In the closed position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. In the open position, the throw contact **1318** is separated from the pole contact **1328** so that there is no conductive path between the first and second prongs **1312**, **1322**.

FIGS. **13**C–D illustrate a SPDT contact set **1301** for a 3-way switch having a second pole buss **1330** in addition to the SPST contact set **1300** (FIGS. **13**A–B). The second pole buss **1330** has a third prong **1332** and a second pole contact **1338**. The flexible throw **1314** engages the actuator **1400**, as described with respect to FIGS. **14**A–B, below, which moves the throw between a first position (shown) and a second position. In a first position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. In a second position, the throw contact **1318** touches and electrically connects with the second pole contact **1338**, establishing a conductive path between the first and third prongs **1312**, **1332**.

FIGS. **13**E–F illustrate a DPDT contact set **1302** for a 4-way switch having a second throw buss **1340** and a third pole buss **1350** in addition to the SPDT contact set **1301**. The second throw buss **1340** has a second flexible throw **1344**. The second throw buss **1340** has a fourth prong **1342**, a second flexible throw **1344** and a second throw contact **1348**. The second pole buss **1330** has the third pole contact **1339**, and the third pole buss **1350** has a fourth pole contact **1359**. In a first position, the throw contact **1318** touches and electrically connects with the pole contact **1328**, establishing a conductive path between the first and second prongs **1312**, **1322**. Also, the second throw contact **1348** touches and electrically connects with the third pole contact **1339**, establishing a conductive path between the third and fourth prongs **1332**, **1342**. In a second position, the throw contact **1318** touches and electrically connects with the second pole contact **1338**, establishing a conductive path between the first and third prongs **1312**, **1332**. Also, the second throw contact **1348** touches and electrically connects with the fourth pole contact **1339**, establishing a conductive path between the second and fourth prongs **1322**, **1342**.

FIGS. **14**A–B illustrate an actuator **1400** having a front face **1401**, a back face **1402** and a lever slot **1410** generally centered within and passing through the front and back faces **1401**, **1402**. The actuator **1400** is positioned within the switch module **900** (FIG. **10**) so that the front face **1401** is proximate the front cover **1200** (FIG. **10**) and the contact set **1300** (FIG. **10**) and the back face **1402** is proximate the spring **1000** (FIG. **10**) and the back cover **1500** (FIG. **10**). The lever slot **1410** accommodates the switch lever tip **1132** (FIG. **11**B), as described above. The front face **1401** has a pair of upper arms **1420** and a pair of lower arms **1430** extending generally perpendicularly from the front face **1401** so as to engage the contact set **1300** (FIGS. **13**A–B). In particular, the flexible throw **1314** (FIGS. **13**A–B) is engaged between the upper arms **1420**. For a DPDT contact set **1302** (FIGS. **13**E–F), a second flexible throw **1344** (FIGS. **13**E–F) is engaged between the lower arms **1430**. The back face **1402** has a pair of posts **1440** that are slidably retained within back cover guides **1550** (FIG. **15**A).

FIGS. **15**A–B illustrate a rear cover **1500** having an inside face **1502**, an outside face **1501**, plug shields **1510**, a key bar **1520**, side catches **1530**, top and bottom latches **1540**, actuator guides **1550**, a spring hold **1560** and contact support structure **1570**. As shown in FIG. **15**B on the outside face **1501**, the plug shields **1510** advantageously provide the shield portion of the shielded plugs **930** (FIG. **9**B). Specifically, the plug shields **1510** completely surround all sides of the contact set prongs **1312**, **1322** (FIGS. **13**A–B). In this manner, the prongs are not exposed when the switch module plugs **930** (FIG. **9**B) are engaged with the wiring module sockets **1810** (FIG. **18**A), even when the switch module **900** (FIGS. **9**A–B) is partially separated from the wiring module

1600 (FIGS. 16A–B). The key bar 1520 is configured to insert into the wiring module ground socket 1820 (FIG. 18A), although the key bar 1520 is nonconductive. The key bar 1520 assists proper orientation of the switch module 900 (FIGS. 9A–B) to the wiring module 1600 (FIGS. 16A–B). The side catches 1530 provide apertures that accept and engage the side latches 1230 (FIGS. 12A–B), and the top and bottom latches 1540 insert into and engage the top and bottom catches 1240 (FIGS. 12A–B) so as to releaseably secure together the front cover 1200 (FIGS. 12A–B) and the back cover 1500.

As shown in FIG. 15A on the inside face 1502, the actuator guides 1550 slidably retain the actuator posts 1440 (FIG. 14B). The spring hold 1560 accommodates and retains the spring 1000 (FIG. 10). The contact support structure 1570 consists of slots through the back cover 1500 and structure extending generally normal to the inside face 1502 that support the contact set 1300 (FIGS. 13A–B). The slots accept the contact set prongs 1312, 1322 (FIGS. 13A–B), which protrude through the back cover 1500 within the plug shields 1510.

Terminal-Block Wiring Module

FIGS. 16A–B illustrate a terminal-block wiring module 1600 having a functional side 1601 and a wiring side 1602. The functional side 1601 has structured sockets 1810 and an off-center ground socket 1820. The structured sockets 1810 accept corresponding functional module shielded plugs, as described with respect to FIG. 20A, below. The wiring module 1600 is configured to mount within a conventional electrical box (not shown), secured with attachment screws 1605. A functional module, such as an outlet module 300 (FIGS. 3A–B) or a switch module 900 (FIGS. 9A–B) plug into the wiring module functional side 1601, secured to the wiring module with attachment screws that thread through attachment ears and corresponding module mounts 1930, as described with respect to FIGS. 1–2, above. A power cable (not shown) routed into the electrical box attaches to a terminal block 1640 (FIG. 16F) accessible from the wiring module wiring side 1602, as described with respect to FIGS. 16E–H, below.

As shown in FIGS. 16A–B, a wiring module 1600 advantageously can be installed, wired and tested by journeyman electrician at the rough-in phase of building construction. The wiring module 1600 is mounted within an electrical box according to the type of functional module for which the wiring module 1600 will be wired. If the wiring module 1600 is mounted in a first orientation (FIG. 1B), the ground socket 1820 is positioned below-center. If the wiring module is mounted in a second orientation (FIGS. 2B, 16A), the ground socket 1820 is positioned above-center. The ground socket 1820 accepts an outlet module ground bar 834 (FIG. 3B) or switch module key bar 1520 (FIG. 9B), which act as keys. Correspondingly, the ground socket 1820 acts as a block that accepts a functional module key 834 (FIG. 3B), 1520 (FIG. 9B) only when the functional module is properly oriented with respect to the wiring module 1600 according to module type, such as a switch or outlet. In one embodiment, the wiring module 1600 is mounted with the ground socket 1820 above-center for a switch module 900 (FIGS. 9A–B) and mounted with the ground socket 1820 below-center for an outlet module 300 (FIGS. 3A–B), as described in further detail with respect to FIGS. 16E–H, below.

FIGS. 16C–D illustrate a terminal-block wiring module 1600 having terminal guards 1700 that advantageously provide covered access to the terminal set 2100 (FIG. 21). In particular, in a closed position (FIGS. 16A–B) the terminal guards 1700 protect users from shock and insulate between closely mounted high voltage devices. In an open position (FIGS. 16C–D), the terminal guards 1700 allow convenient access to the terminal screws 2140 so as to attach or remove power cable wires from the terminal blocks 1640. As shown in FIG. 16C, a hinge 1702 allows a terminal guard 1700 to move from a closed position FIGS. (16A–B) to an open position. A latch 1704 presses into a corresponding catch slot 2220, which retains a terminal guard 1700 in a closed position until it is manually opened. As shown in FIG. 16D, in one embodiment a swivel mount 1709 (FIG. 17B) also allows the terminal guard 1700 to swivel from side to side in an open position, further easing access to the terminal screws 2140.

FIGS. 16E–F illustrate orientation-dependent labels on the wiring module functional and wiring sides, respectively. As described above, the type of functional module to be mounted in the wiring module 1600 determines the mounted orientation of the wiring module 1600 within an electrical box. Color coded labels 1620, 1630 on the functional side (FIG. 16E) and wiring labels 1650, 1660 on the wiring side (FIG. 16F) advantageously indicate to the journeyman electrician the correct wiring module 1600 orientation. The color coded labels 1620, 1630 also advantageously indicate the correct functional module to be installed or replaced. In particular, as shown in FIG. 16E, the color coded labels include a switch label 1620 and an outlet label 1630. The switch label 1620 has an orientation indicator 1622 and corresponding text that specify the wiring module orientation for a switch module 900 (FIGS. 2A–B). In addition, color boxes 1624 advantageously match color indicators 2310 (FIG. 23A) on corresponding switch modules 900. Further, as shown in FIG. 16F, the outlet label 1630 has an orientation indicator 1632 and corresponding text that specify the wiring module orientation for an outlet module 300 (FIGS. 1A–B). Also, color boxes 1634 match an outlet color indicator. In one embodiment, the switch color boxes 1624 are yellow, red and orange matching SP, 3-way and 4-way switch color indicators, respectively. The outlet color boxes 1634 are dark and light blue for full hot and half-hot wiring, matching a blue color indicator for an outlet module. The color boxes 1624, 1634 are marked by the journeyman electrician at wiring module installation to visually indicate the module type for which the wiring module 1600 was wired.

As shown in FIG. 16F, there are four terminal blocks 1640, each having terminal labels "1," "2," "3" and "4" 1670 identifying the individual terminal blocks T1, T2, T3 and T4 by number. In a switch orientation (shown), switch labels 1650 are advantageously positioned in a manner visually corresponding to each of the individual terminal blocks 1640. The switch labels 1650 identify switch wiring for each terminal block by switch type SP, 3-way and 4-way. The outlet labels 1660 are upside down in the switch orientation, visually indicating that they are inapplicable. In an outlet orientation (upside down from that shown), outlet labels 1660 are similarly positioned in a manner visually corresponding to each of the individual terminal blocks 1640. The outlet labels 1660 identify outlet wiring. The switch labels 1650 are upside down in the outlet orientation, visually indicating that they are inapplicable.

FIGS. 16G–H illustrate switch and outlet wiring schematics, respectively, corresponding to the terminal labels 1670 (FIG. 16F), switch labels 1650 (FIG. 16F) and outlet labels 1660 (FIG. 16F) described with respect to FIG. 16F, above. Graphically depicted are groups of four terminals 1690 representing the terminal blocks 1640 (FIG. 16F). Also

depicted are individual terminal blocks **1691**, corresponding hot, neutral, traveler and switch wires **1692**, and links and gaps **1693** corresponding to removable breakaways **2116**.

FIGS. **17**A–B illustrate a terminal-block wiring module **1600** having a wiring panel **1800** and a mounting bracket **1900**. The wiring panel **1800** has a front cover **2000**, a back cover **2200**, a terminal set **2100** and terminal guards **1700**. The front cover **2000** and back cover **2200** are secured together with a fastener (not shown). The mounting bracket **1900** further secures the front cover **2000** to the back cover, as described with respect to FIGS. **18**–**20**, below. The terminal set **2100** is retained within the wiring panel **1800** and provides terminal blocks **1640** (FIG. **16**F) for power cable attachment and provides conductive paths between the terminal blocks **1640** (FIG. **16**F) and structured sockets **1810** (FIG. **18**A). The mounting bracket **1900** advantageously performs multiple functions including securing the wiring module **1600** to an electrical box (not shown), securing together the front and back covers **2000**, **2200**, providing a ground bar clip **1902** (FIG. **19**A) for contact with a module ground bar **834** (FIG. **3**B) and providing a ground terminal **1907** (FIG. **19**A) for a ground wire connection.

As shown in FIGS. **17**A–B, the terminal guards **1700** each have a hinge **1702**, a latch **1704**, a mount **1706**, **1709** and a grip **1708**. The mount **1706**, **1709** slides into a corresponding guard slot **2210** (FIG. **22**A) on each side of the back cover **2200**, which secures each terminal guard **1700** to the wiring panel **1800**. The hinge **1702** advantageously allows a terminal guard **1700** to move between a closed position (FIGS. **16**A–B) blocking inadvertent contact with the terminal blocks **1640** (FIG. **16**F) and an open position (FIGS. **16**C–D) allowing access to the terminal blocks **1640** (FIG. **16**F). The latch **1704** presses into a corresponding catch slot **2220** (FIG. **22**A) on each side of the back cover **2200**, which retains each terminal guard **1700** in a closed position until it is manually opened. A grip **1708** assists in latching the terminal guards **1700**. A stationary mount **1706** (FIG. **17**A) holds the terminal guards **1700** in alignment with the terminal screws **2140** (FIG. **21**). Alternatively, a swivel mount **1709** (FIG. **17**B) advantageously allows the terminal guards **1700** to swivel to either side **1601**, **1602** (FIGS. **16**A–B) of the wiring module for easier access to the terminal screws **2140** (FIG. **21**).

FIGS. **18**A–B illustrate a wiring panel **1800** having a front side **1801** and a back side **1802**. The front side **1801** has structured sockets **1810**, a ground socket **1820** and bracket slots **1830**. The back side **1802** has terminal blocks **1640** (FIG. **16**F) formed by a terminal set **2100** (FIG. **21**) having terminal screws **2140** (FIG. **21**) that are accessed through the terminal guards **1700**, as described above.

FIGS. **19**A–B illustrate a mounting bracket **1900** having a bracket body **1901**, a ground clip **1902** and a ground terminal **1907**. The ground clip **1902** is attached to the bracket body **1901** with a rivet **1905**. The ground terminal **1907** provides a ground termination for a ground wire (not shown). The bracket **1900** has swages **1910**, box mounts **1920** and module mounts **1930**. The bracket **1900** is configured to be disposed around the rear cover **2200** (FIGS. **22**A–B) with the swages **1910** inserted through front cover slots **2020** (FIGS. **20**A–B) and spread against the front cover outside **2001** so as to secure together the front and rear covers **2000**, **2200**. A fastener **1909** is inserted through the bracket and into the wiring panel front cover **2000**, so as to secure together the front and rear covers **2000**, **2200**. The box mounts **1920** allow the wiring module **1600** (FIGS. **16**A–B) to be secured to an electrical box (not shown) and are configured to removably engage a box cover (FIGS. **27**–**29**). The module mounts **1930** allow functional modules **300** (FIGS. **3**A–B), **900** (FIGS. **9**A–B) to be secured to the wiring module **1600** (FIGS. **16**A–B). The ground clip **1902** is configured to physically and electrically connect to a module ground bar **834** (FIGS. **8**A–B).

In an alternative embodiment, the mounting bracket **1900** does not have swages **1910**. Multiple fasteners **1909** are inserted through the mounting bracket **1900** and into the wiring panel front cover **2000**, so as to secure together the front and rear covers **2000**, **2200**. After the mounting bracket **1900** is attached to the front cover **2000**, ears at the top and bottom of the mounting bracket **1900** are bent over and against the front cover outside **2001** to further secure together the front and rear covers **2000**, **2200**. Trusses are included across or proximate to folded portions of the mounting bracket **1900** to strengthen the bracket structure. The box mount **1920** may have an alternative shape so as to accommodate a box cover **2700** (FIGS. **27**A–B).

FIGS. **20**A–B illustrate a front cover **2000** having an outside face **2001** and an inside face **2002**. As shown in FIG. **20**A on the outside face **2001**, raised guards **2010** and surrounding channels **2014** provide the nonconductive portions of structured sockets **1810** (FIG. **18**A). Each raised guard **2010** and surrounding channel **2014** are configured to mate with a corresponding plug shield **610** (FIG. **6**B). In particular, when a functional module is plugged into the wiring module **1600** (FIGS. **16**A–B), shields **610** (FIG. **6**B), **1510** (FIG. **15**B) insert into channels **2014**, guards **2010** insert within shields **610** (FIG. **6**B), **1510** (FIG. **15**B), and prongs **702** (FIGS. **7**A–B) plug into power clips **2112** (FIG. **21**). This interlocking action of the shield plugs **330** (FIG. **3**B), **930** (FIG. **9**B) and the structured sockets **1810** (FIG. **18**A) advantageously provides a fully enclosed shield as an electrical connection is made between a functional module and a wiring module, in addition to tactile feedback and a solid mechanical and electrical connection. Further, the guards **2010** and channels **2014** reduce the chance of an inadvertent contact between a tool, such as a screwdriver tip, and a hot contact within a socket **1810** (FIG. **18**A). For example, a tool dragged across the wiring panel front side **1801** (FIG. **18**A) during service will tend to lodge in the channel **2014** or against the raised guard **2010** or both. In a particular embodiment, the shields **610** (FIG. **6**B), **1510** (FIG. **15**B) and the corresponding channels **2014** and raised guards **2010** are generally rectangular in shape with rounded corners.

As shown in FIG. **20**B, the inside face **2002** has swage slots **2020**, a ground aperture **2030** and terminal support structure **2050**, **2060**. The swage slots **2020** accommodate the mounting bracket swages **1910** (FIG. **19**A), which assist to secure together the front and back covers **2000**, **2200**. The ground aperture **2030** accommodates a ground bar **834** (FIG. **3**B) or key bar **1520** (FIG. **9**B) as part of a ground socket **1820** (FIG. **18**A). The support structure **2050**, **2060** houses the terminal set **2100** (FIG. **21**).

FIG. **21** illustrates a terminal set **2100** having contact busses **2110**, terminal clamps **2130** and terminal screws **2140**. The contact busses **2110** each have power clips **2112** that provide the conductor portion of the structured sockets **1810** (FIG. **18**A). The power clips **2112** are configured to physically and electrically connect with module prongs **702** (FIGS. **7**A–B), **1312**, **1322** (FIGS. **13**A–B). The terminal clamps **2130** and terminal screws **2140** terminate power cables (not shown) to the contact busses **2110**. The terminal clamps **2130** are configured to secure one wire per channel **2132**. Advantageously, this provides a four-wire capacity for

each of four terminal blocks **1640** (FIG. **16**F). In one embodiment, each terminal block **1640** (FIG. **16**F) is configured for four **14** gauge copper wires or two **12** gauge copper wires. Breakaways **2116** are removable to selectively isolate individual terminal blocks **1640** (FIG. **16**F).

FIGS. **22**A–B illustrate a back cover **2200** having an inside face **2202** and an outside face **2201**. The inside face **2202** has mount slots **2210** and catch slots **2220** that retain the terminal guards **1700** (FIG. **17**), as described above. The inside face **2202** also has terminal slots **2230** that retain the terminal set. The outside face **2201** is shaped to accommodate the mounting bracket **1900** (FIGS. **19**A–B) and accommodate power cable attachment to the terminal blocks **1640** (FIG. **16**F).

Dimmer Switch Module

FIGS. **23**A–B illustrate a dimmer switch module **2300** having a switch **2410** and a dimmer lever **2460** on a front side **2301** and shielded plugs **2330** and a key bar **2350** on a back side **2302**. The top of the switch module **2300** also has a color label **2310**. The color label **2310** corresponds in color to one of the wiring module color labels **1624**. In this manner, the switch module color label **2310** advantageously provides a visual indication of proper module orientation and avoids installation into a wiring module **1600** (FIGS. **16**E–F) wired for a different module type. Similar color labels of differing colors may be applied in a similar fashion to outlet modules **300** (FIGS. **3**A–B) and other switch modules **900** (FIGS. **9**A–B) for the same purpose. FIG. **24** illustrates the dimmer switch module **2300** including a switch **2410**, a front cover **2420**, a bracket **2430**, a circuit board **2440**, a back cover **2450** and a dimmer lever **2460**.

Fixed-Wire Wiring Module

FIGS. **25**A–B illustrate a fixed-wire wiring module **2500** having a functional side **2501** and a wiring side **2502**. The wiring module **2500** is configured to mount within a conventional electrical box (not shown), secured with attachment screws (not shown) threaded through box mounts **2652**. A functional module, such as an outlet module **300** (FIGS. **3**A–B) or a switch module **900** (FIGS. **9**A–B) plug into the wiring module functional side **2501**, secured to the wiring module **2500** with attachment screws (not shown) that thread through attachment ears (not shown) and corresponding module mounts **2654**, as described with respect to FIGS. **1**–**2**, above. A power cable (not shown) routed to the electrical box attaches to pushwire connectors **2570** at the end of fixed wires **2550** extending from the wiring module wiring side **2502**.

FIGS. **26**A–B illustrate a fixed-wire wiring module **2500** having a front cover **2610**, a back cover **2620**, a terminal set **2630**, a mounting bracket **2650**, a ground bar clip **2660** and fasteners **2670**. The front cover **2610** and back cover **2620** are secured together with the fasteners **2670** and enclose the terminal set **2632**. Advantageously, the mounting bracket **2650** is partially enclosed by, and retained between, the front cover **2610** and back cover **2620** so as to secure the mounting bracket **2650** to, and mechanically and electrically integrate the mounting bracket with, the wiring module **2500**.

As shown in FIGS. **26**A–B the front cover **2610** has structured sockets **2612**, a ground aperture **2614**, support structure **2616** and fastener posts **2618**. The structured sockets **2612** interlock with functional module shielded plugs and the ground aperture **2614** accommodates a ground bar or key bar as part of a ground socket in a manner as described with respect to FIGS. **20**A–B, above. The support structure **2616** houses the terminal set **2630**. The fastener posts **2618** align with fastener apertures **2624** and accept the fasteners **2670** securing the front cover **2610** to the back cover **2620**.

Also shown in FIGS. **26**A–B, the terminal set **2630** has power clips **2632**, fixed wire terminals **2634** and breakaways **2638**. The power clips **2632** provide the conductor portion of the structured sockets **2612** and are configured to physically and electrically connect with module prongs in a manner as described with respect to FIG. **21**, above. The fixed wire terminals **2634** electrically and mechanically connect a stripped end of the fixed wires **2550** (FIGS. **25**A–B) to the terminal set **2630**. The breakaways **2638** are removable to selectively isolate individual power clips **2632**.

Further shown in FIGS. **26**A–B, the mounting bracket **2650** is adapted to a channel extending lengthwise along the front cover **2610** and corresponding support structure extending lengthwise along the back cover **2620**. The mounting bracket **2650** has box mounts **2652**, module mounts **2654**, a ground clip aperture **2656** and a ground terminal **2658**. The box mounts **2652** accept fasteners (not shown) to secure the bracket to an electrical box (not shown). The module mounts **2654** accept fasteners (not shown) to secure a functional module (not shown) to the wiring module **2500**. The ground clip aperture **2656** is adapted to the ground clip **2660**, which connects a functional module ground bar electrically and mechanically to the bracket **2650**. The bracket has an integrated rivet for securing the ground clip **2660** within the aperture **2656**. The ground terminal **2658** electrically and mechanically connects a stripped end of a ground one of the fixed wires **2550** (FIGS. **25**A–B) to the bracket **2650**.

Additionally shown in FIGS. **26**A–B, the back cover **2620** has wire apertures **2622**, fastener apertures **2624** and a breakaway aperture **2626**. The wire apertures **2622** are adapted to the fixed wires **2550** (FIGS. **25**A–B) so as to provide a seal around and strain relief for the fixed wires and access to the terminal set **2630** and ground terminal **2658**. The fastener apertures **2624** accept that portion of the fasteners **2670** that thread into or are otherwise secured to the fastener posts **2618**. The breakaway aperture **2626** allows user access to the breakaways **2638** within an assembled wiring module **2500**.

Electrical Box Cover

FIGS. **27**A–B illustrate an electrical box cover **2700** having a generally planar cover plate **2710**, clamps **2720**, catches **2730**, trusses **2740** and markers **2750**. The cover plate **2710** has a front side **2701** and a back side **2702**. The clamps **2720** are located, one each, generally centered on the top and bottom of the cover plate **2710** and extend generally perpendicularly from the back side **2702**. The catches **2730** are apertures, one for each catch **2730**, that are generally centered on the catches **2720** and extending along the juncture between the catches **2730** and the cover plate **2710**. The trusses **2740** are protrusions on the cover plate **2740** that extend substantially along the length of the front side **2701**, providing structural support to resist bending of the cover plate **2710**. The markers **2750** are generally round protrusions on the front side **2701** of the cover plate **2740** located, one each, proximate the top and bottom of the cover plate **2740**.

FIGS. **28**A–B illustrate an electrical box **2800** that is covered and uncovered, respectively, by a box cover **2700**, as described with respect to FIGS. **27**A–B, above. The box cover **2700** removably mounts over the electrical box open face **2801** so as to prevent material such as plaster and paint from fouling the wiring module **1600** during the makeup

phase of construction. Advantageously, the box cover **2700** mounts generally flush with the electrical box open face **2801** and, hence, generally flush with installed drywall so as not to interfere with drywall construction during the makeup phase. Drywall, once loosely positioned, can be pressed against the box cover **2700**. In doing so, the markers **2750** dimple the drywall, advantageously marking the location of the electrical box **2800** so that drywall cutouts can be accurately made to accommodate the electrical box **2800**.

As shown in FIGS. **28**A–B, the box cover **2700** is installed on the box mounts **1920** of a wiring module **1600** mounted within the electrical box **2800**. In particular, the clamps **2720** flex somewhat to slide over the box mounts **1920** until the box mounts **1920** insert into corresponding catches **2730**. The box cover **2700** can be easily removed by flexing the clamps **2720** so that a box mount **1920** clears a corresponding catch **2730**.

FIG. **29** illustrate a 2-gang electrical box **2900** with overlapping box covers **2700**. The box covers **2700** are configured so that a first portion **2791** of one cover overlaps a second portion **2792** of another cover so as to prevent drywall related material from entering between the covers **2700** and fouling the electrical box **2900** interior.

Terminal Shield

FIGS. **30**A–B illustrate a terminal-block wiring module **1600** having a terminal shield **3100** installed on a wiring side **1602** using fasteners **1909**. The terminal shield **3100** advantageously prevents bare copper ground wires (not shown), which typically are connected between the ground terminal **1907** (FIG. **17**A) and an electrical box (not shown), from inadvertently protruding through the back cover **2200** (FIG. **17**A) and short circuiting the terminal set **2100** (FIG. **17**A).

FIGS. **31**A–B illustrate a terminal shield **3100** having a front side **3101**, a back side **3102** and a spine **3105**. Mounting ears **3110** extend from both ends of the spine **3105**, and shield wings **3120** extend from both sides of the spine **3105**. Breakaway guards **3130** extend from a central portion of each shield wing **3120**. A V-shaped hinge **3135** extending across a portion of each breakaway guard **3130** allows the breakaway guards **3130** to flex somewhat to gain access for removal of one or both of the breakaways **2116** (FIG. **16**F), as described with respect to FIGS. **16**G–H, above. Mounting apertures **3140** are defined in the mounting ears **3110**, wire apertures **3150** are defined in the shield wings **3120**, and a bracket aperture **3160** is defined in a central portion of the spine **3105**.

As shown in FIGS. **31**A–B, the terminal shield **3100** is installed with the back side **3102** proximate the wiring module **1600** (FIG. **30**A) and the front side **3101** distal the wiring module **1600** (FIG. **30**A). In particular, the spine **3105** fits against the bracket **1900** and the bracket aperture **3160** accommodates protrusions due to the ground clip **1902** (FIG. **17**A) or its associated fastener. The mounting apertures **3140** accept the fasteners **1909** (FIG. **30**A), which also secure together the wiring module **1600** (FIG. **30**A). The shield wings **3120** cover exposed portions of the terminal set **2100** (FIG. **17**A), and the wire apertures **3150** accommodate wire ends that are connected to the terminal set **2100** (FIG. **17**A).

Other Functional Modules

Although described above with respect to outlet and switch modules, the electrical distribution system may operate in conjunction with a variety of functional modules providing various electrical functions, such as security modules, data transfer modules, computing modules, home entertainment modules and intelligent home product modules to name a few. For example, a security module may incorporate a video camera or motion sensor. A data transfer module may incorporate data storage devices, wireless transceivers or AC power line transceivers. A computing module may incorporate a microprocessor, a data entry or display device, for example. A home entertainment module may work in conjunction with speakers, LCD panels or plasma TVs. A home product module, for instance, may incorporate a microcontroller and a wireless or an AC power line transceiver for appliance control.

Sealed Wiring Modules

FIGS. **32**A–B illustrate a sealed wire wiring module **3200** having a functional side **3201** and a wiring side **3202**. Advantageously, a shield **3360** is disposed proximate the wiring side **3202** and configured to seal the wiring module **3200** so as to protect electricians and users alike from inadvertent exposure to potentially hazardous electrical power. As shown in FIGS. **32**A–B, the wiring module **3200** is mounted within a conventional electrical box (not shown) and secured with attachment screws (not shown) threaded through box mounts **3342**. A functional module, such as an outlet module or a switch module plug into the wiring module functional side **3201**, secured to the wiring module **3200** with attachment screws (not shown) that thread through attachment ears (not shown) and corresponding module mounts **3344**. A power cable (not shown) routed to the electrical box attaches to push wire connectors **3270** at the end of fixed wires **3250** extending from the wiring module wiring side **3202**.

FIGS. **33**A–B illustrate a sealed wiring module **3200** having a front cover **3310**, a centered open back cover **3320**, a terminal set **3330**, a mounting bracket **3340**, a ground bar clip **3350**, a shield **3360** and fasteners **3370**. The front cover **3310** and back cover **3320** are secured together with the fasteners **3370** and enclose the terminal set **3330**. The mounting bracket **3340** is partially enclosed by, and retained between, the front cover **3310** and back cover **3320** so as to secure the mounting bracket **3340** to, and mechanically and electrically integrate the mounting bracket **3340** with, the wiring module **3200**.

As shown in FIGS. **33**A–B, the front cover **3310** has structured sockets **3312**, a ground aperture **3314**, support structure **3316** and fastener posts **3318**. The structured sockets **3312** interlock with functional module shielded plugs, and the ground aperture **3314** accommodates a ground bar or key bar. The support structure **3316** houses the terminal set **3330**. The fastener posts **3318** align with fastener apertures **3324** and accept the fasteners **3370** securing the front cover **3310** to the back cover **3320**.

Also shown in FIGS. **33**A–B, the terminal set **3330** has power clips **3332**, fixed wire terminals **3334** and breakaways **3338**. The power clips **3332** provide the conductor portion of the structured sockets **3312** and are configured to physically and electrically connect with functional module prongs. The fixed wire terminals **3334** electrically and mechanically connect stripped ends of the fixed wires **3250** to the terminal set **3330**. The fixed wires **3250** are adapted to transfer electrical power from the power cable to the terminal set **3330** and, hence, to the structured sockets **3312**. The breakaways **3338** are removable to selectively isolate individual power clips **3332**.

Further shown in FIGS. **33**A–B, the mounting bracket **3340** is housed in a channel extending lengthwise along the front cover **3310** and corresponding support structure extending lengthwise along the back cover **3320**. The mounting bracket **3340** has box mounts **3342**, module

mounts **3344**, a ground clip aperture **3346** and a ground terminal **3348**. The box mounts **3342** accept fasteners (not shown) to secure the bracket to an electrical box (not shown). The module mounts **3344** accept fasteners (not shown) to secure a functional module (not shown) to the wiring module **3200**. The ground clip aperture **3346** is adapted to the ground clip **3350**, which connects a functional module ground bar electrically and mechanically to the bracket **3340**. The bracket has an integrated rivet for securing the ground clip **3350** within the aperture **3346**. The ground terminal **3348** electrically and mechanically connects a stripped end of a ground one of the fixed wires **3250** to the bracket **3340**.

Additionally shown in FIGS. **33**A–B, the back cover **3320** has wire apertures **3322**, fastener apertures **3324** and breakaway apertures **3326**. The wire apertures **3322** are adapted to the fixed wires **3250** so as to provide a seal around and strain relief for the fixed wires and access to the terminal set **3330** and ground terminal **3348**. The fastener apertures **3324** accept those portions of the fasteners **3370** that thread into or are otherwise secured to the fastener posts **3318**. The breakaway apertures **3326** allow access to the breakaways **3338** within an assembled wiring module **3200**.

Further shown in FIGS. **33**A–B, the shield **3360** is attached to the back cover **3320** so as to enclose the breakway aperture **3326**. That is, the back cover **3320** and shield **3360** combined completely enclose the terminal set **3330** at the wiring side **3202** (FIG. **32**B) so that there are no exposed power conductors. The shield **3360** has a mounting wall **3362** and knockouts **3364**. The mounting wall **3362** is disposed proximate the center of the shield **3360** and has extensions connecting both of the knockouts **3364**. The knockouts **3364** extend generally perpendicularly from the mounting wall extensions. The mounting wall **3362** has a mounting hole **3366** accommodating a fastener **3380** so that the shield **3360** fixedly attaches to the back cover **3320**. The knockouts **3364** are individually removable to provide access to the breakways **3338**.

An electrical distribution wiring module has been disclosed in detail in connection with various embodiments. These embodiments are disclosed by way of examples only and are not to limit the scope of the claims that follow. One of ordinary skill in the art will appreciate many variations and modifications.

What is claimed is:

1. An electrical distribution apparatus comprising:

a wiring module having a functional side, an opposite wiring side and a mounting bracket; and

a cover removably mounted to the wiring module;

wherein the wiring module is configured to mount within an electrical box so as to connect the wiring side to a power cable routed to the electrical box,

wherein the mounting bracket has box mounts configured to secure the mounting bracket to the electrical box,

wherein the cover is disposed generally flush with an open face of the electrical box when the wiring module is mounted within the electrical box so that the cover prevents plaster and other material from fouling the wiring module during wall panel installation, and

wherein the cover is removed to expose the wiring module functional side after wall panel installation so as to allow a functional module to plug into sockets disposed on the wiring module functional side.

2. The electrical distribution apparatus according to claim **1** wherein the cover comprises:

a generally planar cover plate having an area extending substantially across the electrical box open face;

a plurality of cover mounts generally centered proximate a top edge and proximate a bottom edge of the cover plate; and

apertures defined on the cover mounts for securing the cover plate to the wiring module box mounts.

3. An electrical distribution method comprising the steps of:

providing an electrical box for routing an electrical power cable;

installing a wiring module within the electrical box, wherein the wiring module is configured to connect to the power cable and distribute electrical power according to a functional module that is pluggable into the wiring module;

removably mounting a cover to the wiring module so that the cover extends generally flush over an open face of the electrical box;

removing the cover after wall panel installation so as to plug the functional module into the wiring module.

4. The electrical distribution method according to claim **3** comprising the further steps of:

extending a mounting bracket from the wiring module;

disposing a plurality of box mounts on opposite portions of the mounting bracket;

attaching the box mounts to the electrical box proximate the electrical box open face so as to secure the wiring module within the electrical box;

disposing a plurality of cover mounts generally centered proximate opposite edges of the cover; and

attaching the cover mounts to the box mounts so as to secure the cover over the electrical box open face.

5. An electrical distribution apparatus comprising:

an electrical box having an open face and configured to route a power cable in communications with electrical power;

a wiring module installed within the electrical box and configured to connect to the power cable, mount a functional module, and distribute electrical power according to the functional module;

a mounting bracket extending from the wiring module and configured to mount the wiring module within the electrical box;

a plurality of box mounts disposed on the mounting bracket for securing the wiring module to the electrical box; and

a cover plate removably mounted to the wiring module mounting bracket and disposed generally flush to the electrical box open face so as to prevent foreign material from entering the electrical box during wall construction.

6. The electrical distribution apparatus according to claim **5** further comprising:

a plurality of cover mounts generally centered proximate a top edge and proximate a bottom edge of the cover plate; and

apertures defined on the cover mounts for securing the cover plate to the wiring module box mounts.

7. The electrical distribution apparatus according to claim **6** wherein the electrical box is a multi-gang electrical box, the apparatus further comprising:

a second cover plate removably mounted to a second wiring module and disposed generally flush to the open face of the multi-gang electrical box,

wherein portions of the cover plate and second cover plate overlap so as to prevent foreign material from entering the multi-gang box between the cover plates.

* * * * *

EXHIBIT E

US007367121B1

(12) **United States Patent**
Gorman

(10) **Patent No.: US 7,367,121 B1**
(45) **Date of Patent: May 6, 2008**

(54) **ELECTRICAL WIRING METHOD**

(75) Inventor: **Michael Gorman**, Laguna Niguel, CA (US)

(73) Assignee: **ProtectConnect**, Irvine, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 60 days.

(21) Appl. No.: **11/354,264**

(22) Filed: **Feb. 14, 2006**

Related U.S. Application Data

(60) Continuation of application No. 10/685,294, filed on Oct. 14, 2003, now abandoned, which is a continuation of application No. 10/023,393, filed on Dec. 17, 2001, now abandoned, which is a division of application No. 09/553,425, filed on Apr. 19, 2000, now Pat. No. 6,341,981.

(60) Provisional application No. 60/174,521, filed on Jan. 5, 2000.

(51) **Int. Cl.**
H01R 43/00 (2006.01)
H05K 13/00 (2006.01)

(52) **U.S. Cl.** **29/854**; 29/831; 29/857; 29/868; 29/874; 29/876; 29/884; 174/53; 174/57; 174/59; 439/107; 439/535

(58) **Field of Classification Search** 29/854, 29/831, 857, 868, 874, 876, 884; 174/53, 174/57, 59; 439/107, 535
See application file for complete search history.

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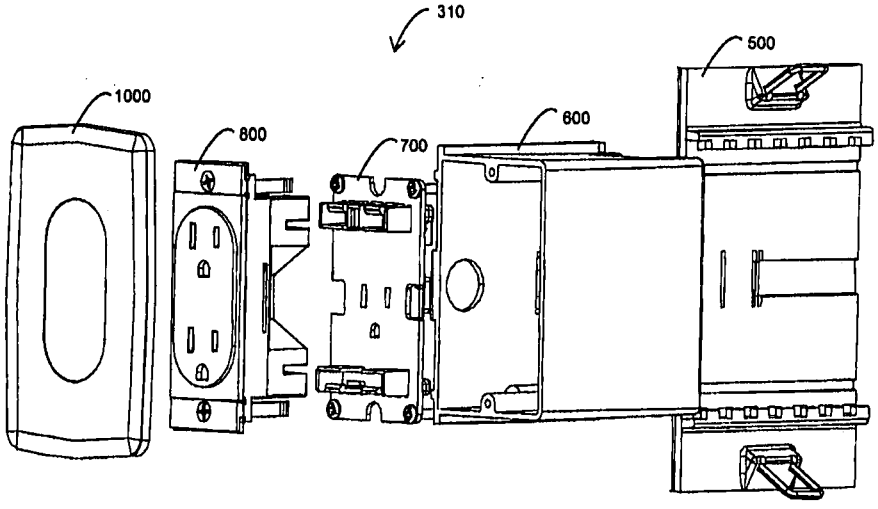
Primary Examiner—Thiem D. Phan
(74) *Attorney, Agent, or Firm*—Knobbe Martens Olson & Bear LLP

(57) **ABSTRACT**

An electrical box is mounted on a wall stud, and a wiring panel is installed within the electrical box so as to partition the interior of the electrical box into a user inaccessible wiring compartment and a user accessible module compartment. A protective cover is attached to the wiring panel so as to protect the wiring panel during a makeup phase of wall panel installation and painting. After the makeup phase, the protective cover is removed from the wiring panel and a module having a user operable electrical function is mounted to the wiring panel within the user accessible module compartment.

5 Claims, 46 Drawing Sheets



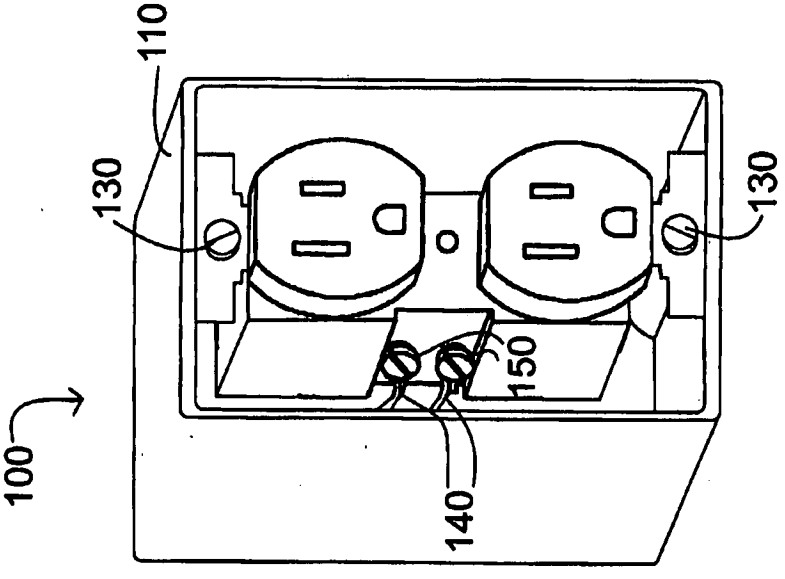


FIG. 1 (Prior Art)

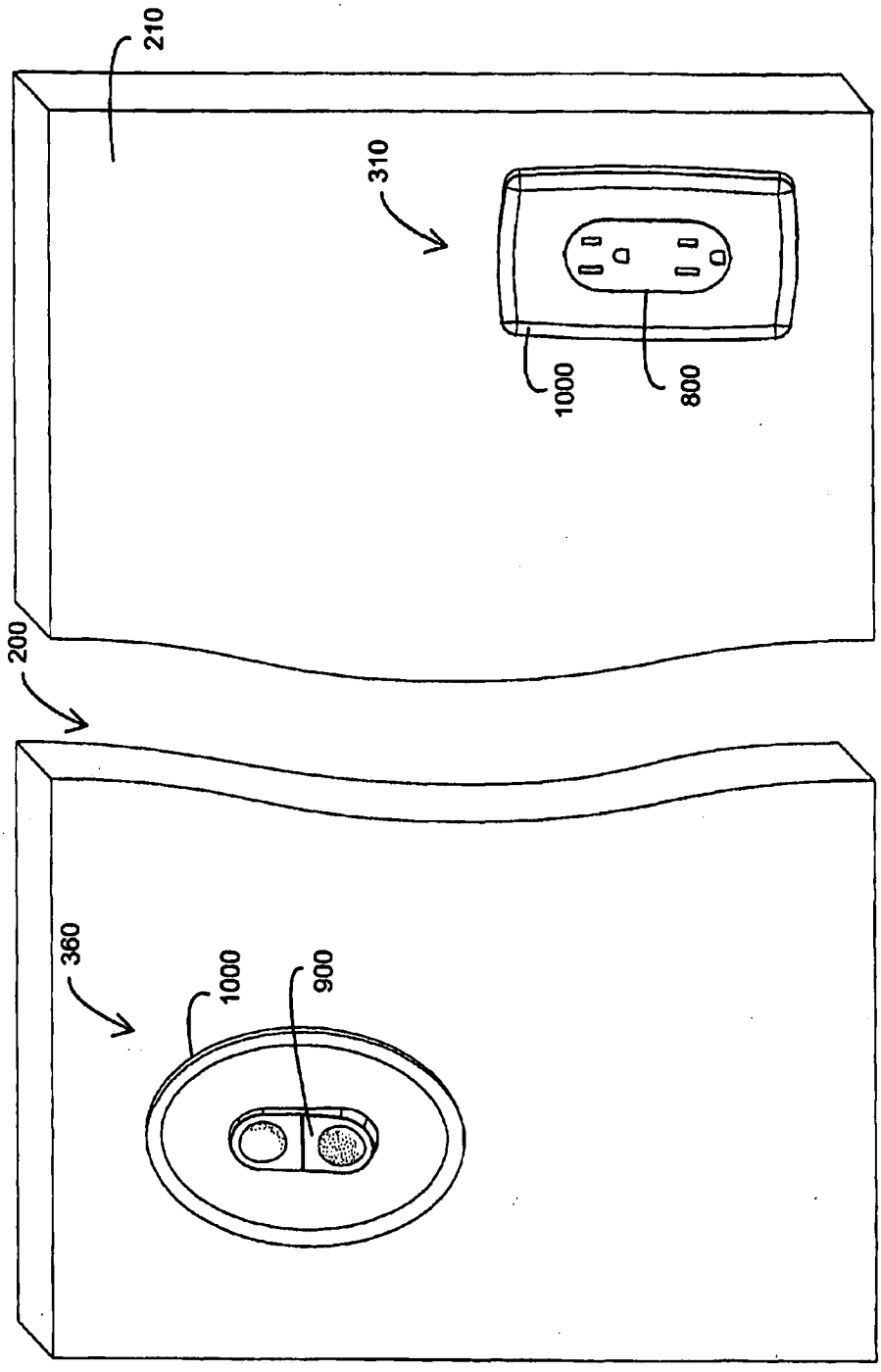


FIG. 2

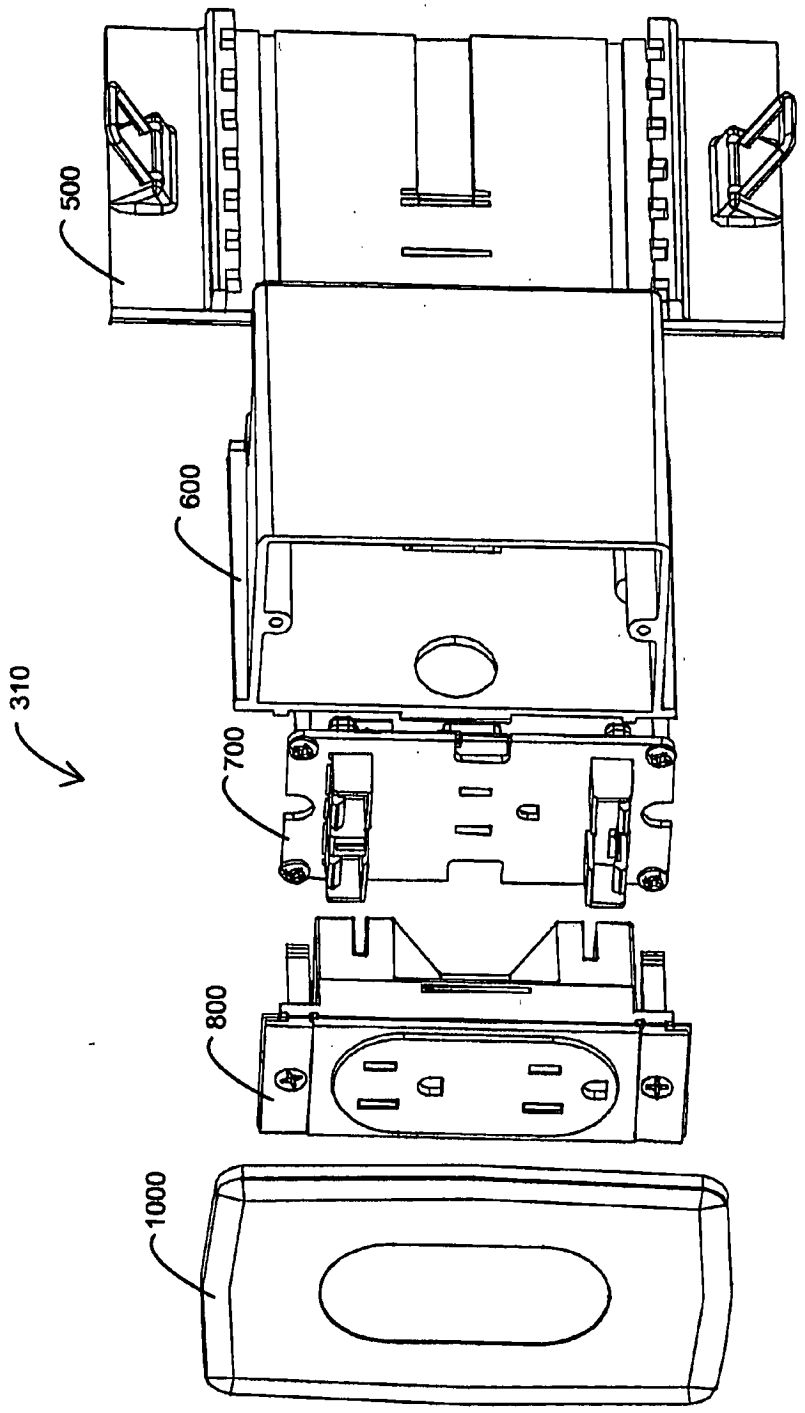


FIG. 3A

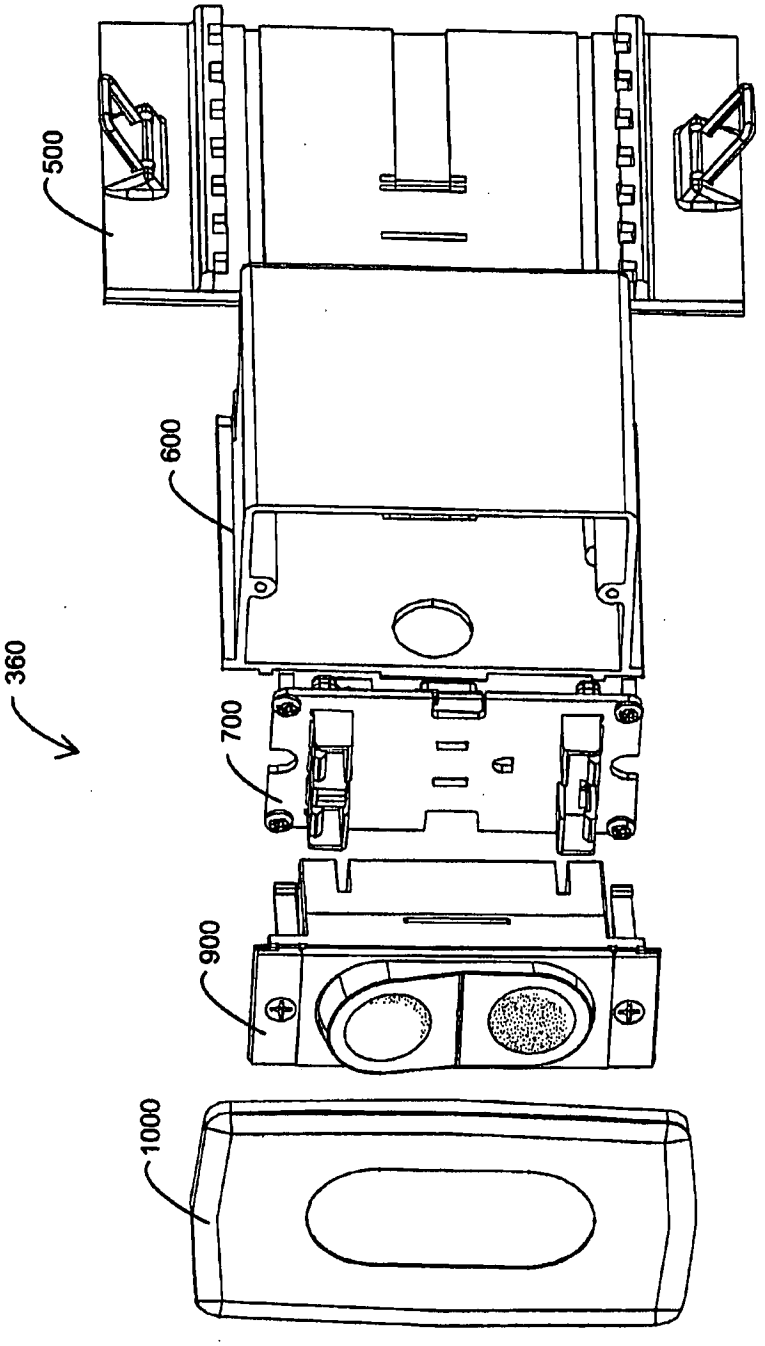


FIG. 3B

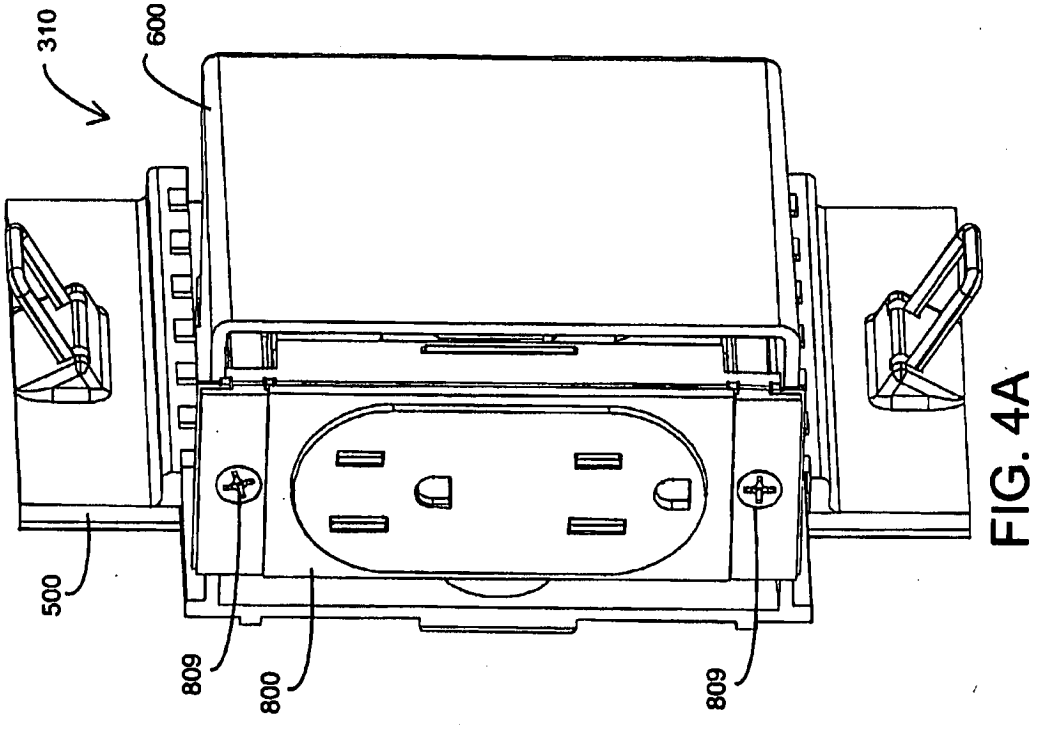


FIG. 4A

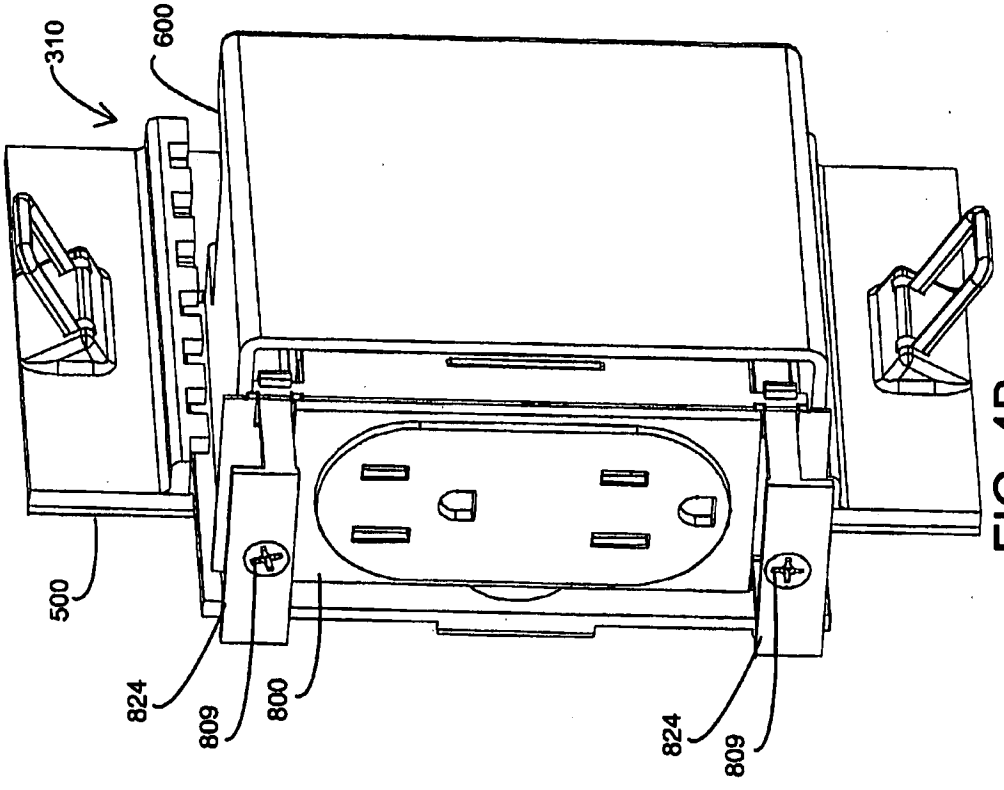


FIG. 4B

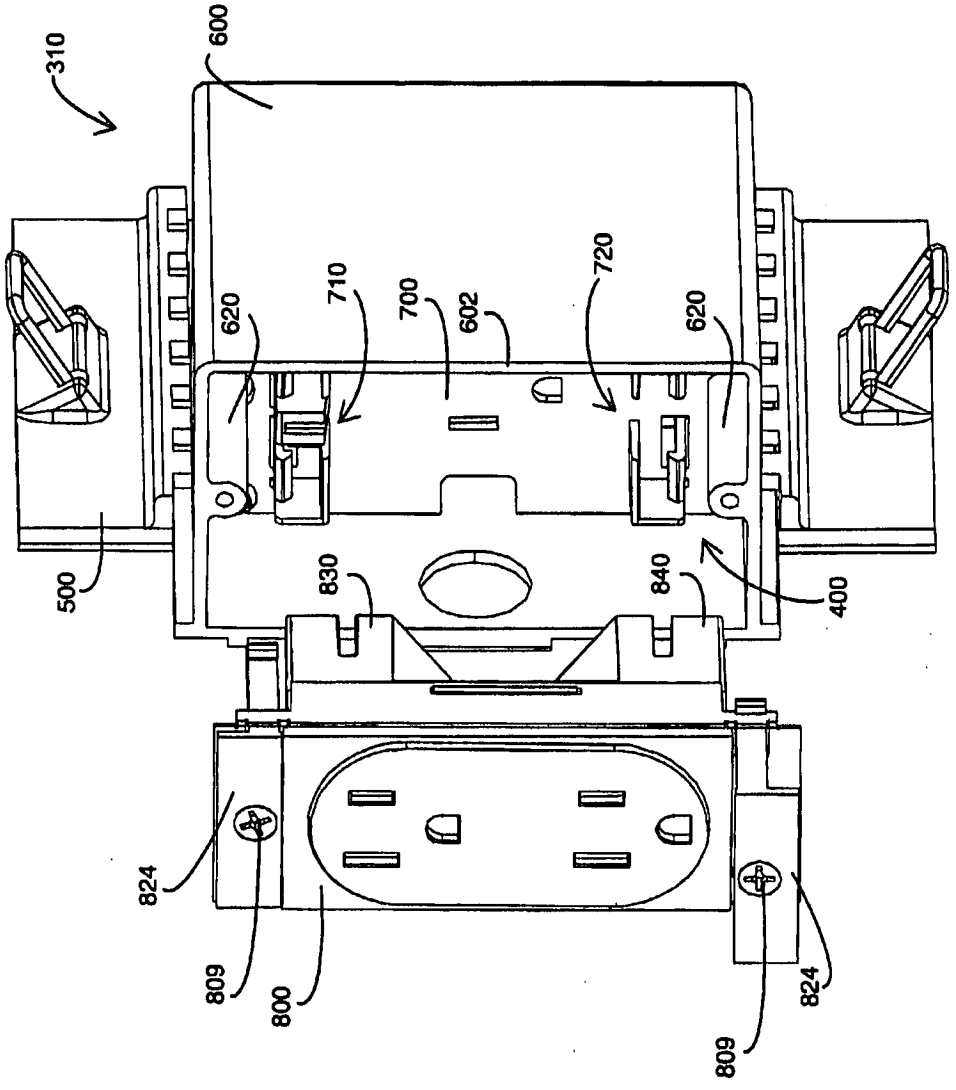

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FIG. 4C

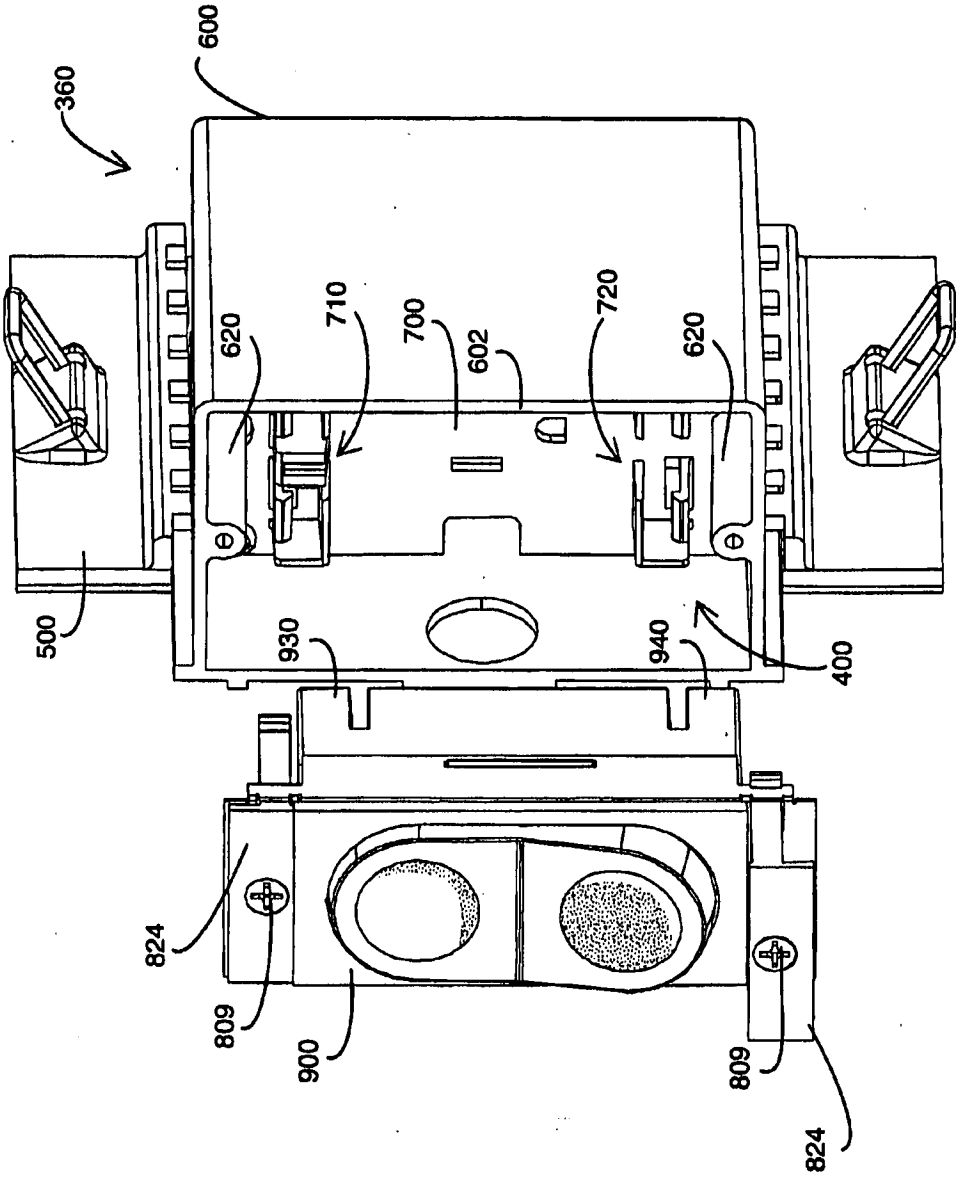
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FIG. 4D

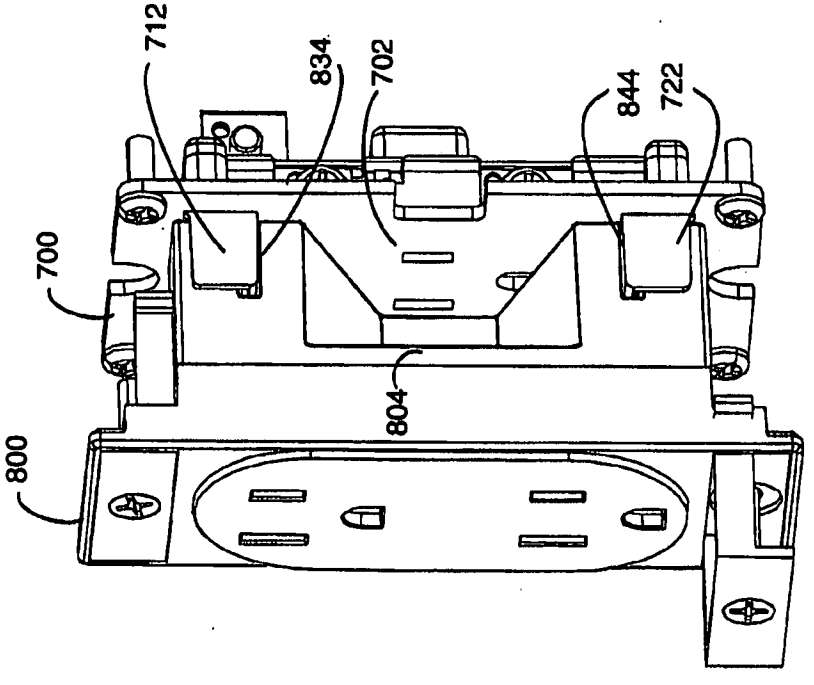

FIG. 4E

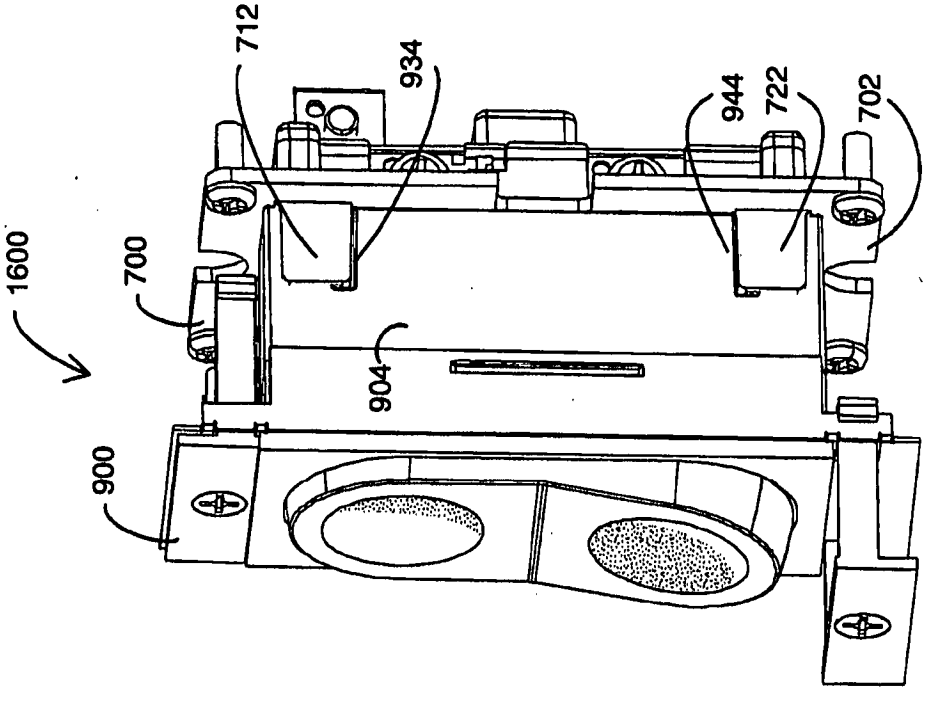

FIG. 4F

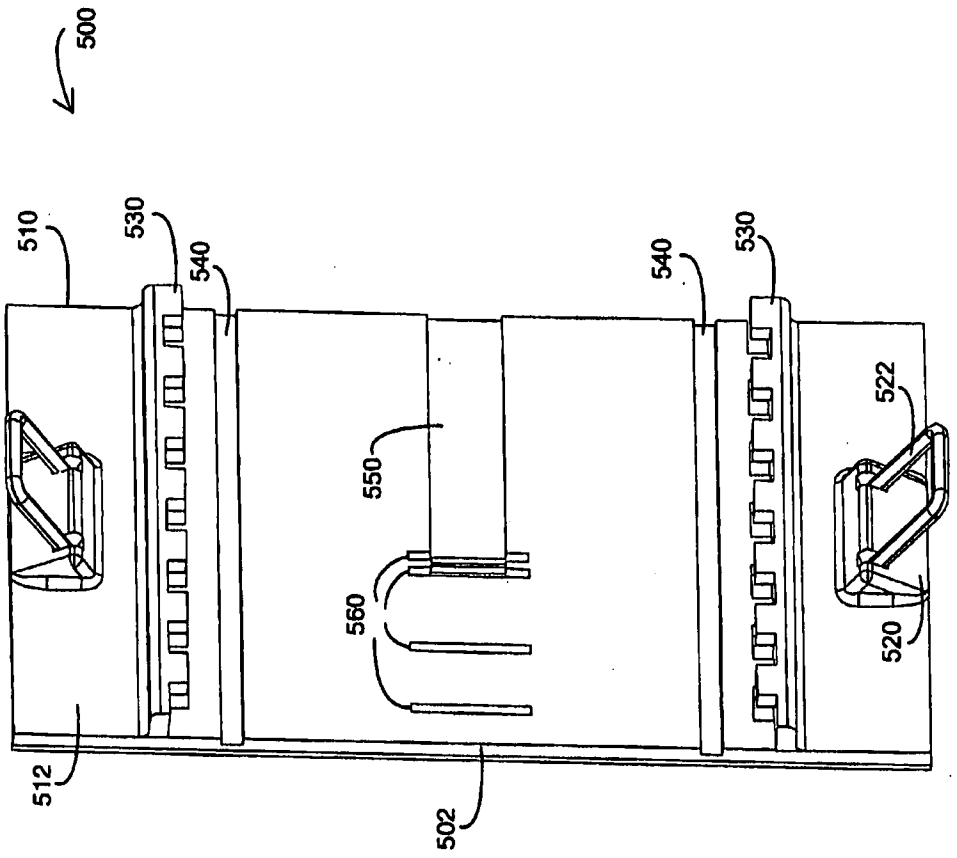

FIG. 5A

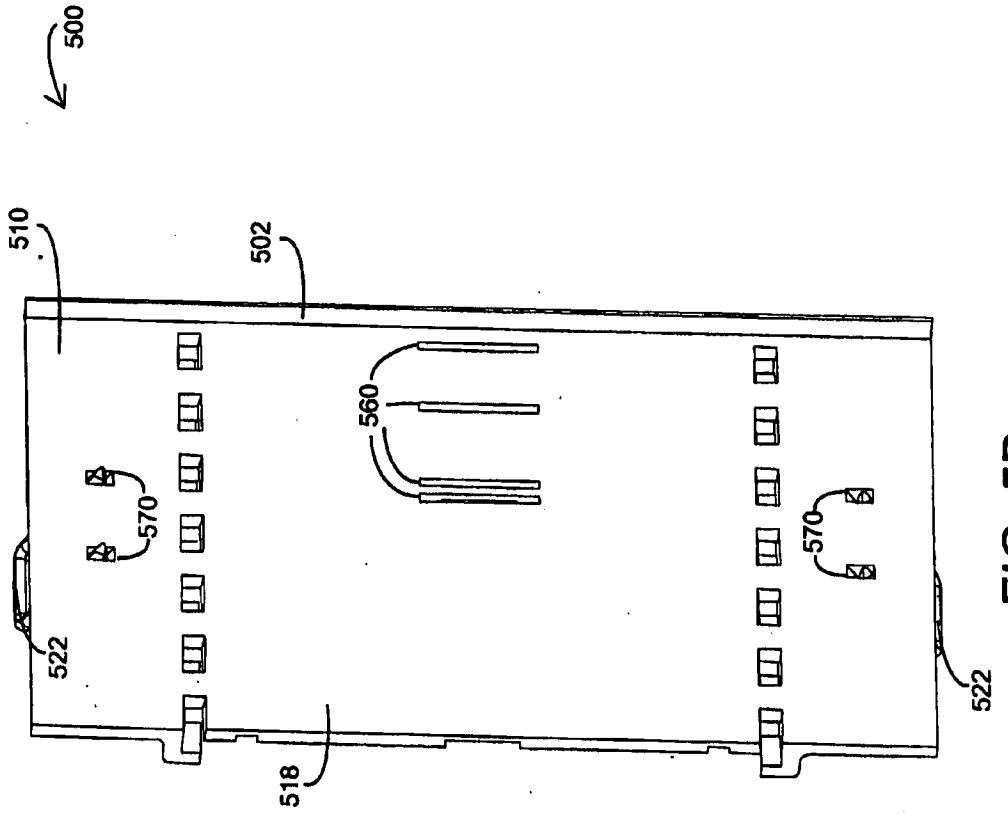

FIG. 5B

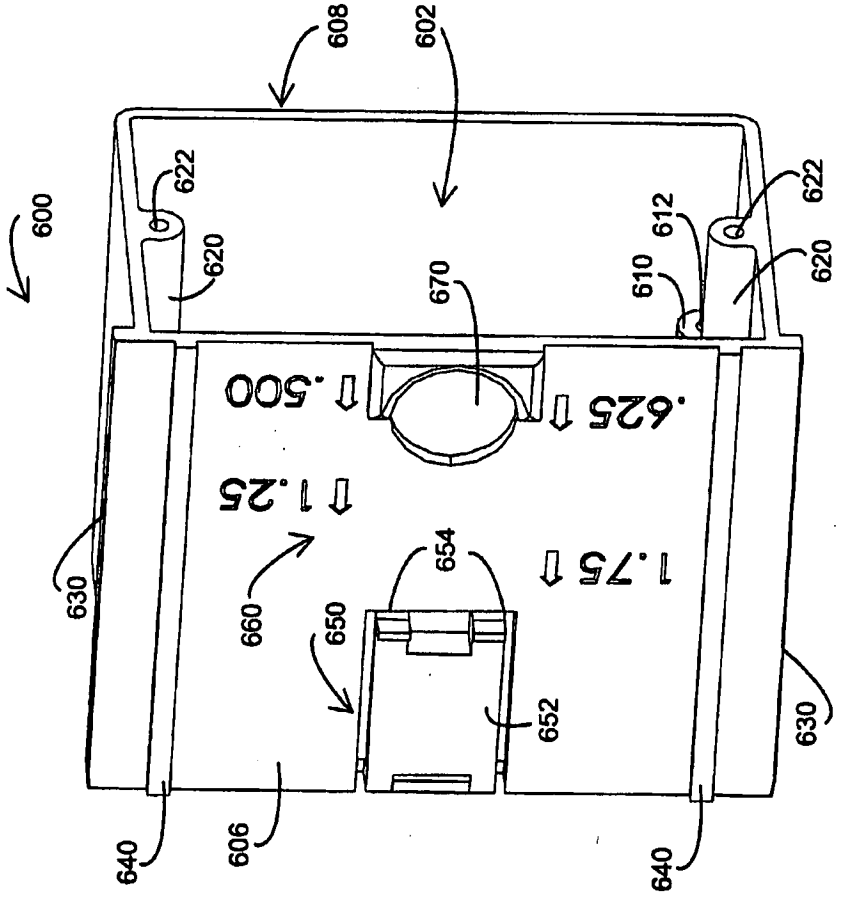
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FIG. 6A

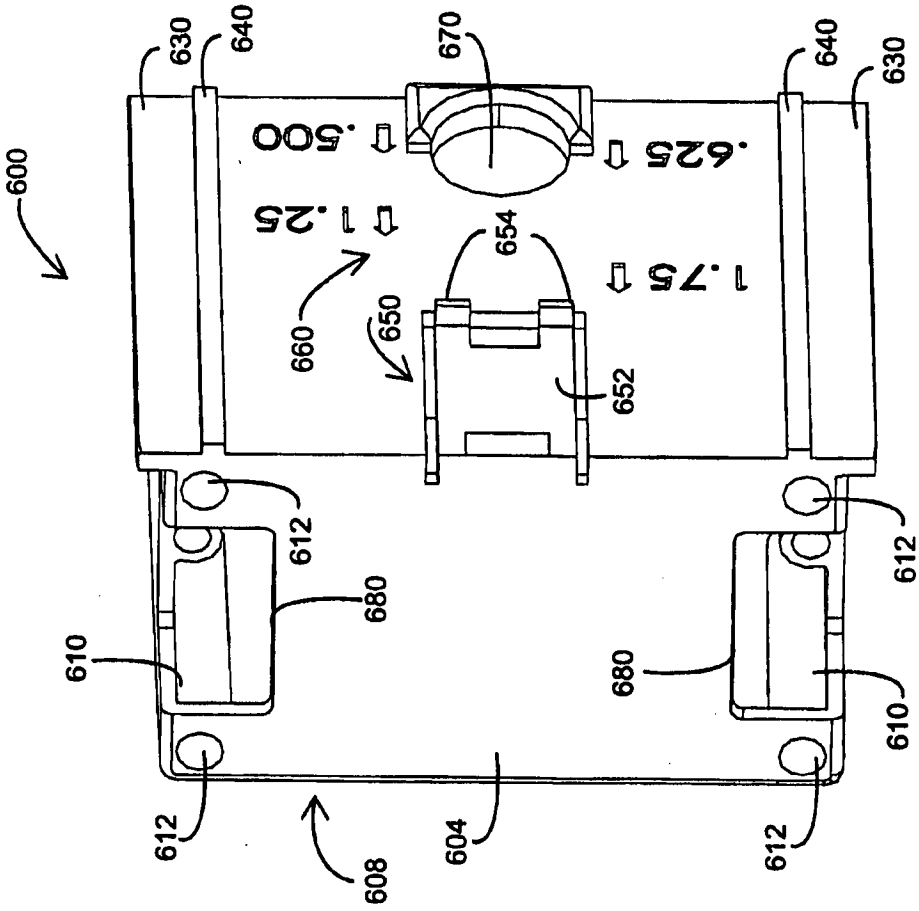
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FIG. 6B

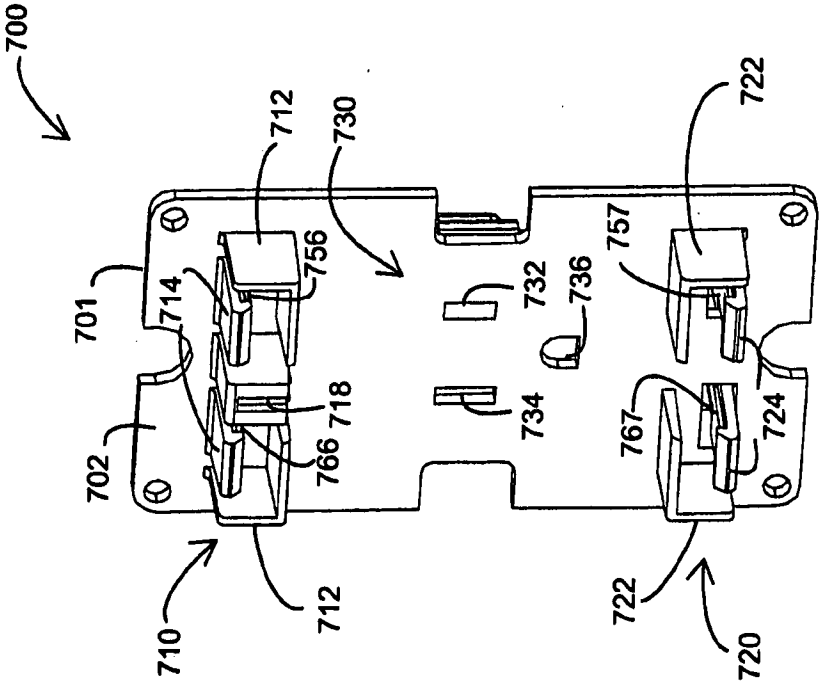
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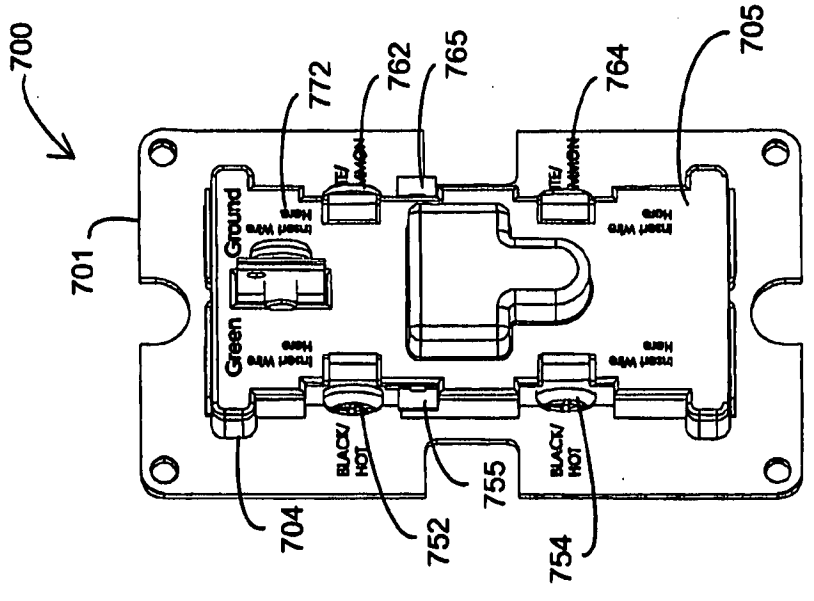
FIG. 7A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TE/ MAIN
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754

FIG. 7B

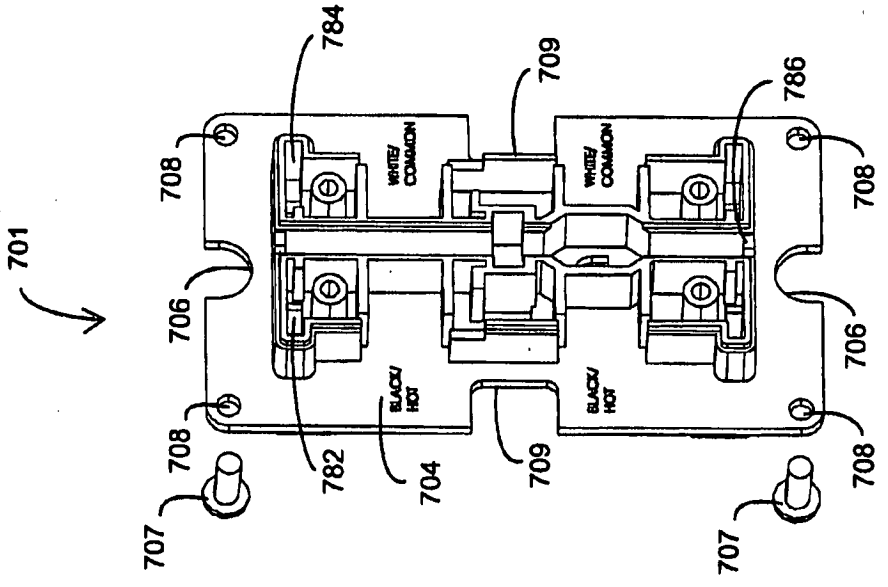
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FIG. 7C

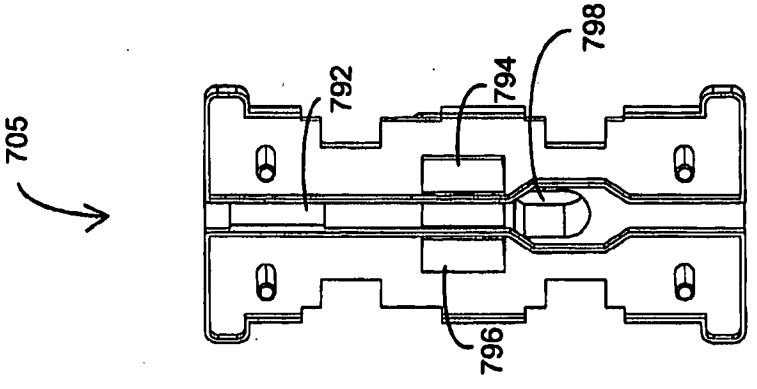

FIG. 7D

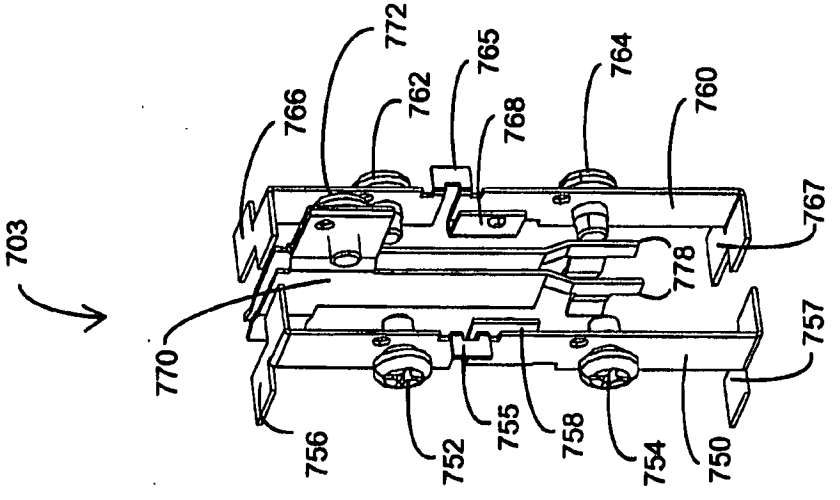
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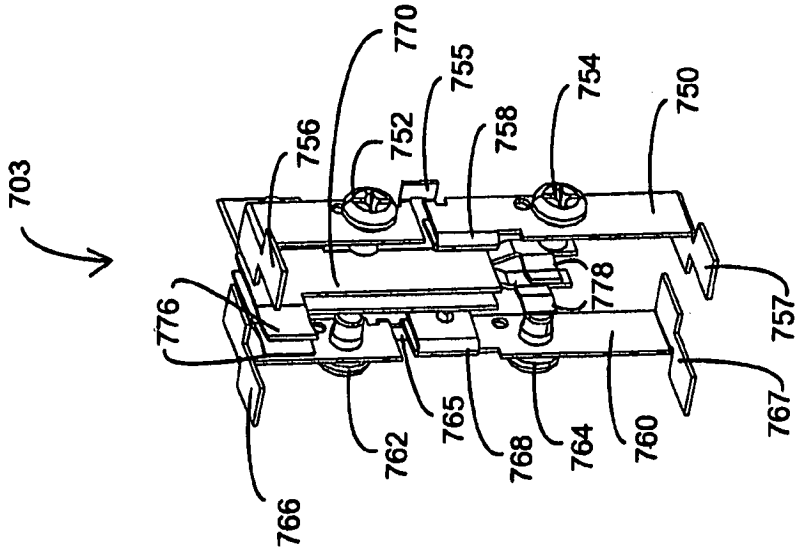
FIG. 7E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766

FIG. 7F

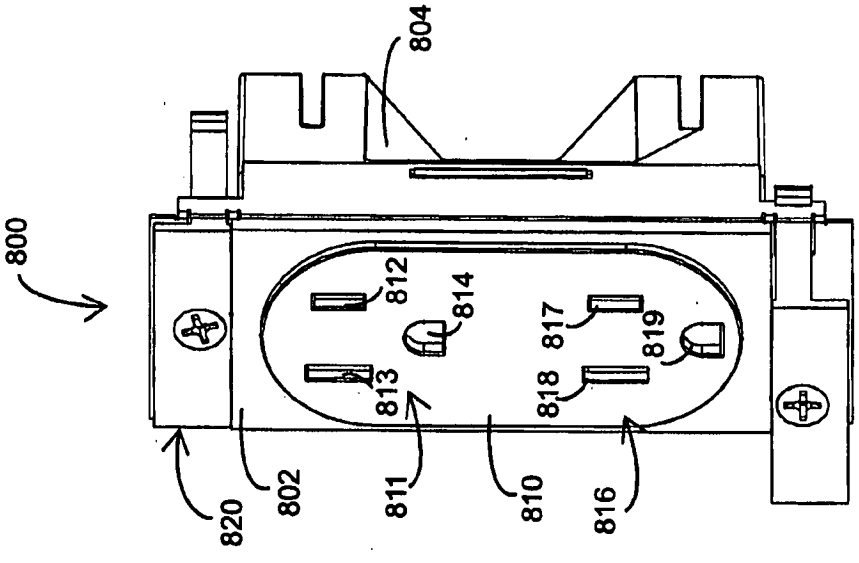

FIG. 8A

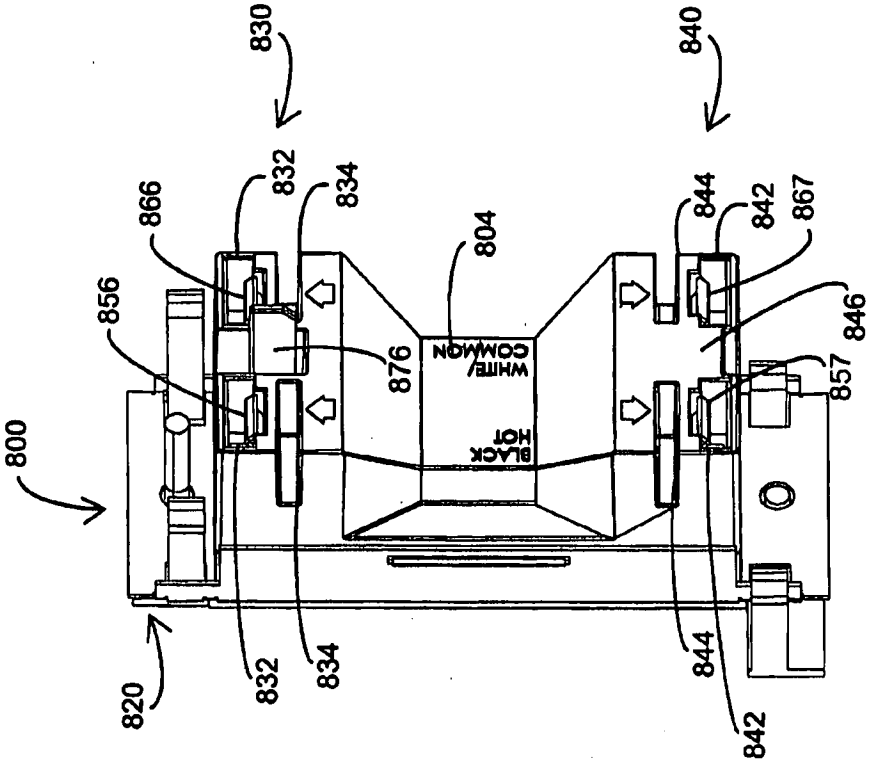
830
840
832
834
866
804
844
842
867
856
846
876
WHITE/ COMMON
857
800
BLACK HOT
820
832
834
844
842

FIG. 8B

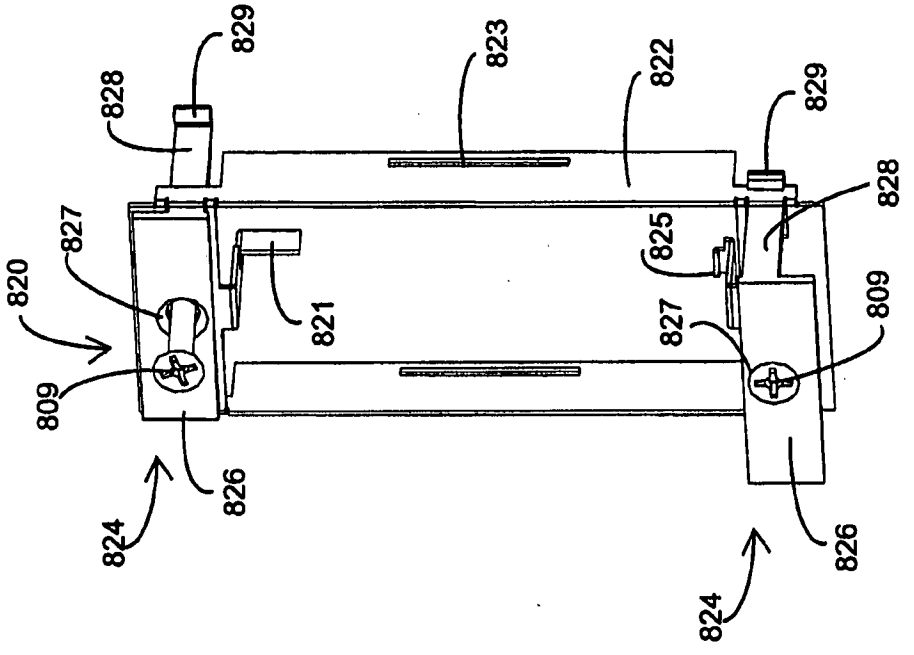
829
823
822
829
828
828
827
825
820
821
827
809
809
826
826
824
824

FIG. 8C

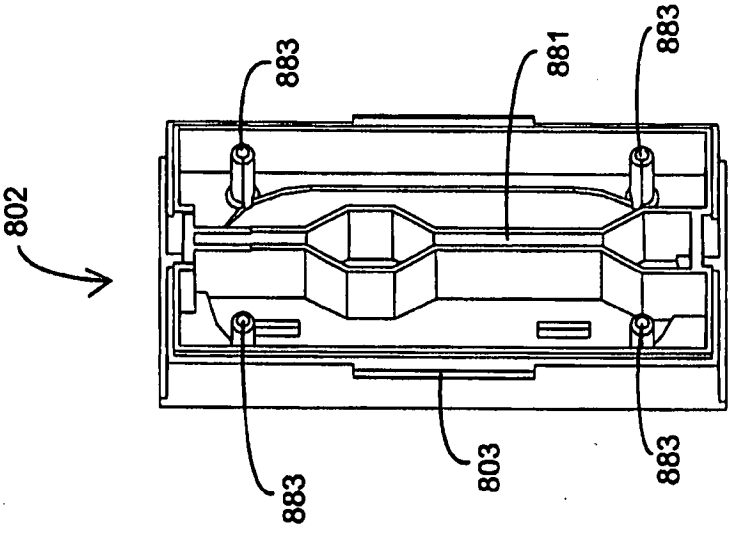

FIG. 8D

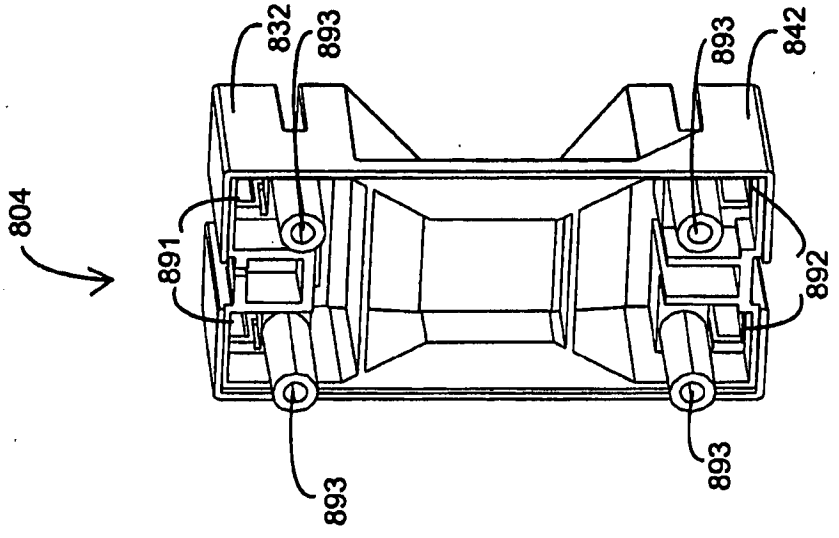

FIG. 8E

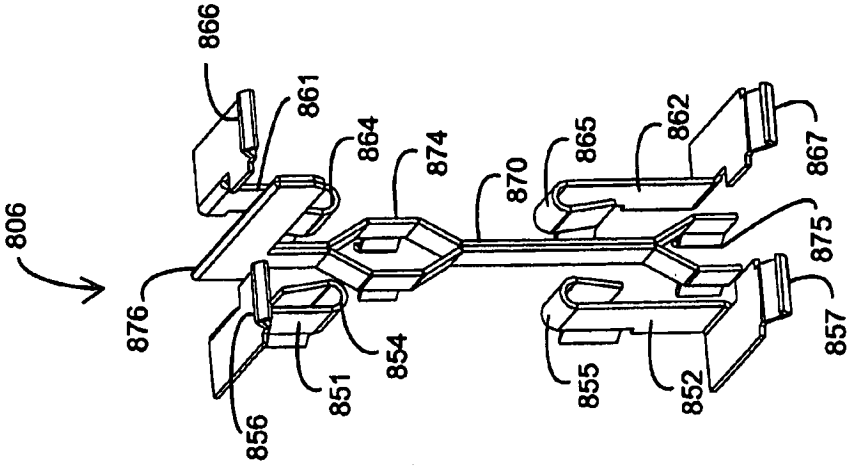
866
861
864
874
870
865
862
867
806
875
876
857
854
851
856
855
852

FIG. 8F

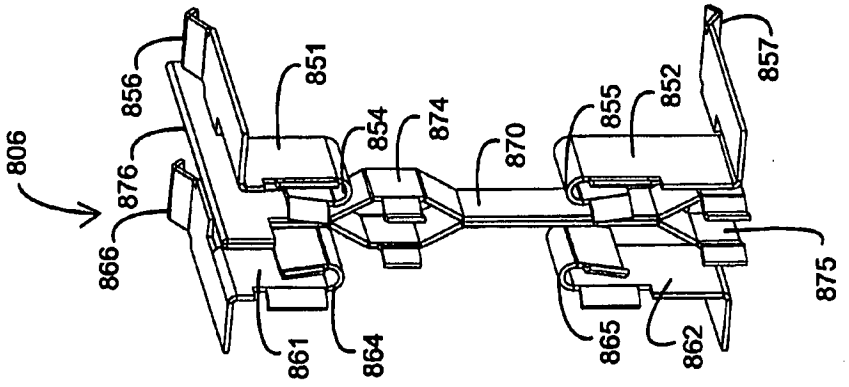

FIG. 8G

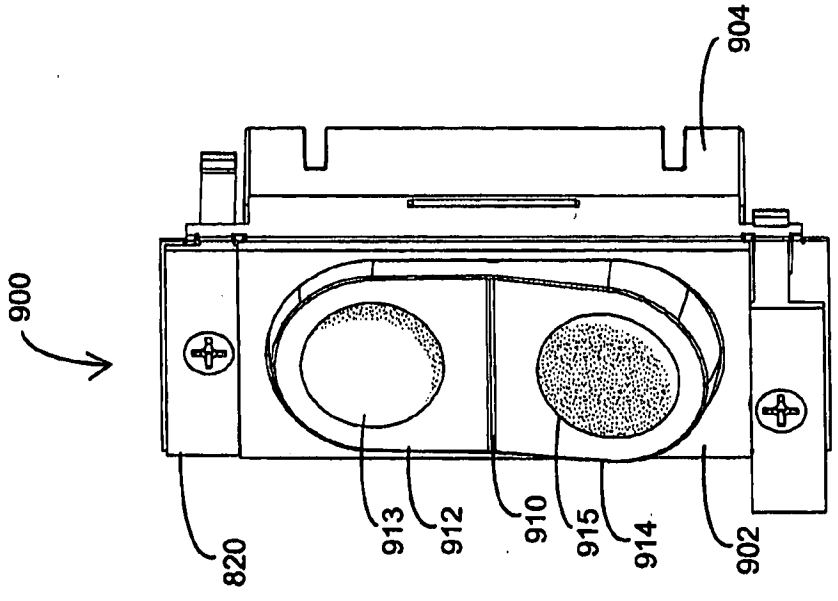

FIG. 9A

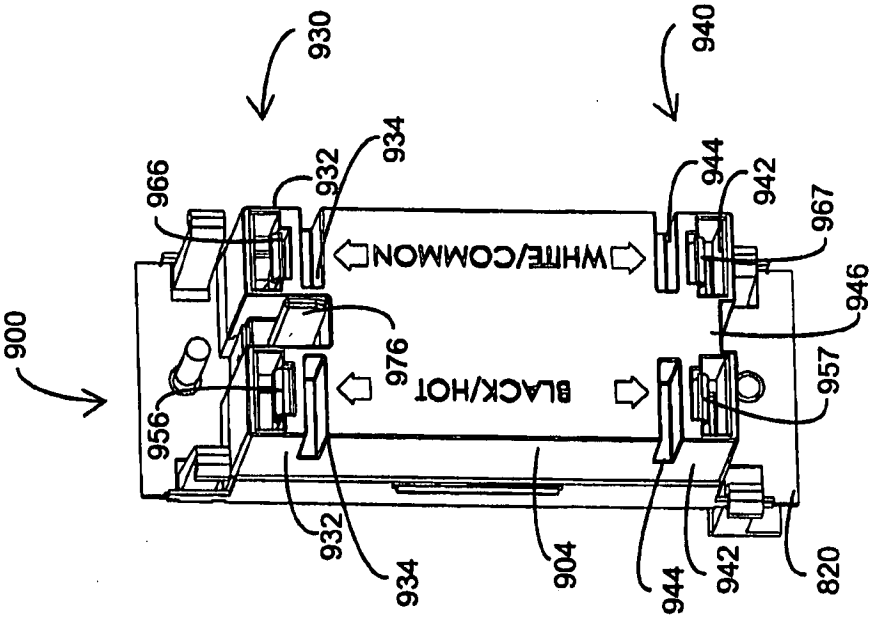
930
940
966
932
934
944
942
967
WHITE/COMMON
946
900
976
BLACK/HOT
957
956
932
934
904
944
942
820

FIG. 9B

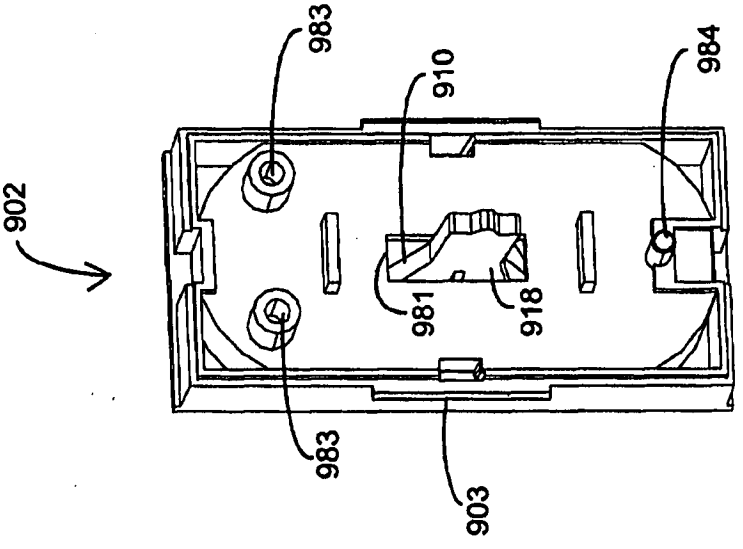

FIG. 9C

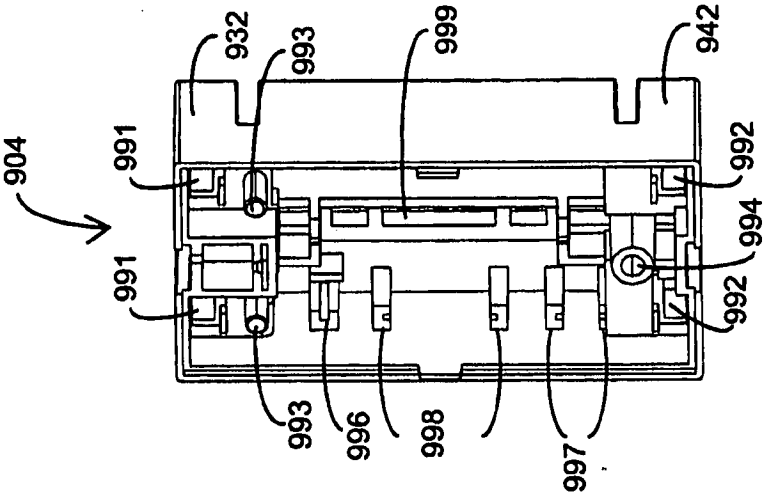

FIG. 9D

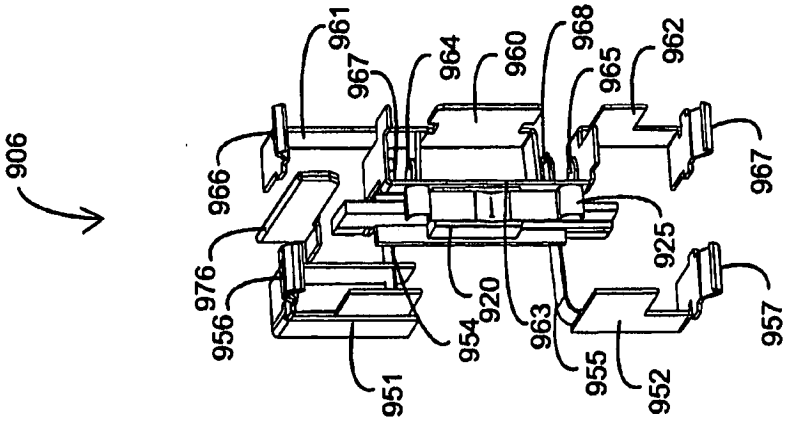
906
961
967
964
960
968
965
962
966
967
925
976
956
920
954
963
955
957
951
952

FIG. 9E

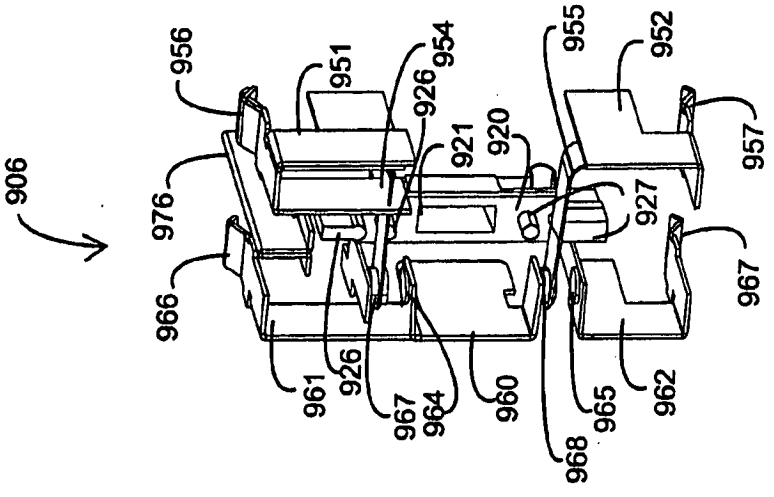
906
956
951
954
926
955
952
921
920
957
976
927
966
967
961
926
967
964
960
965
962
968

FIG. 9F

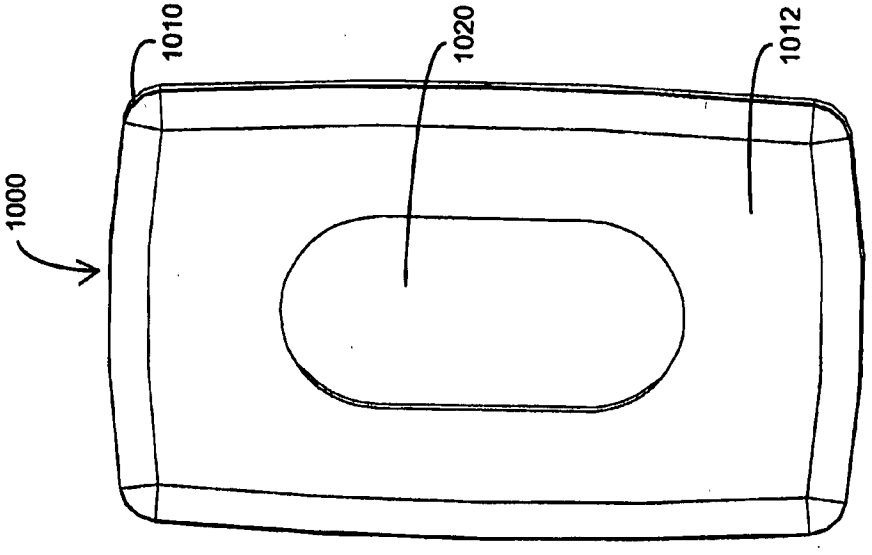

FIG. 10A

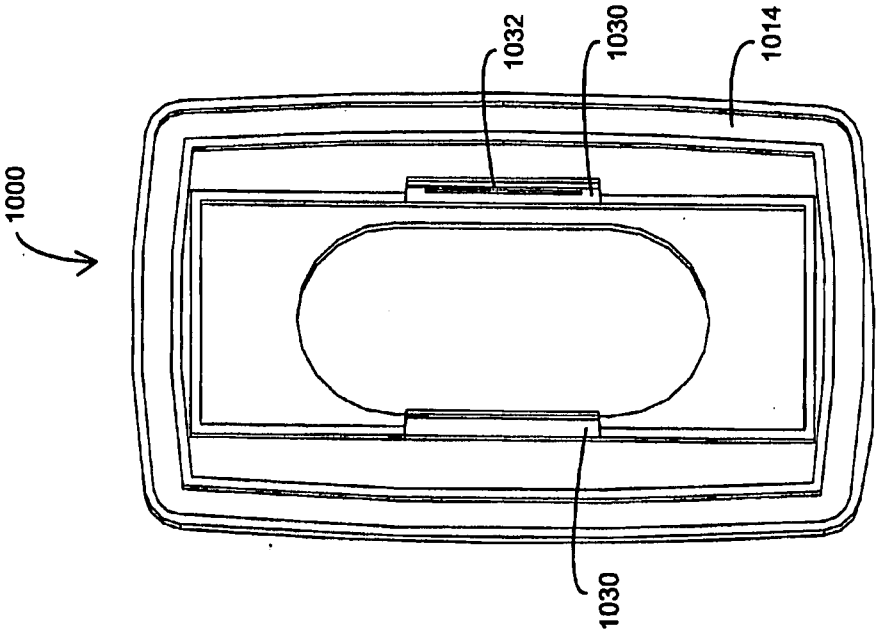

FIG. 10B

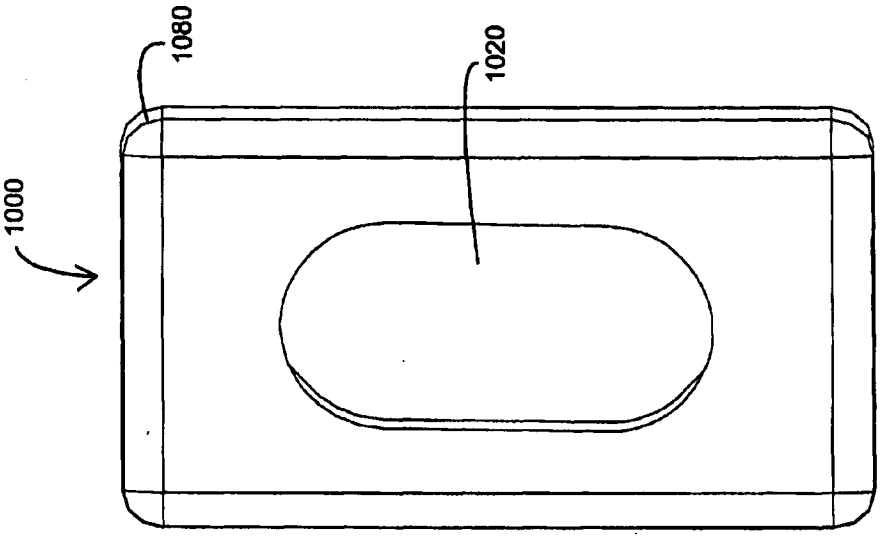

FIG. 10C

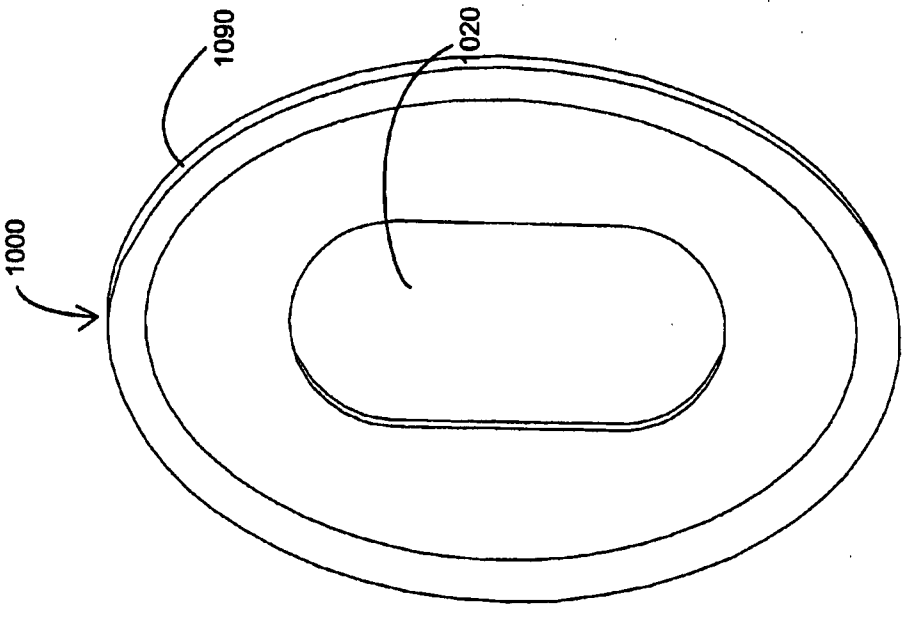

FIG. 10D

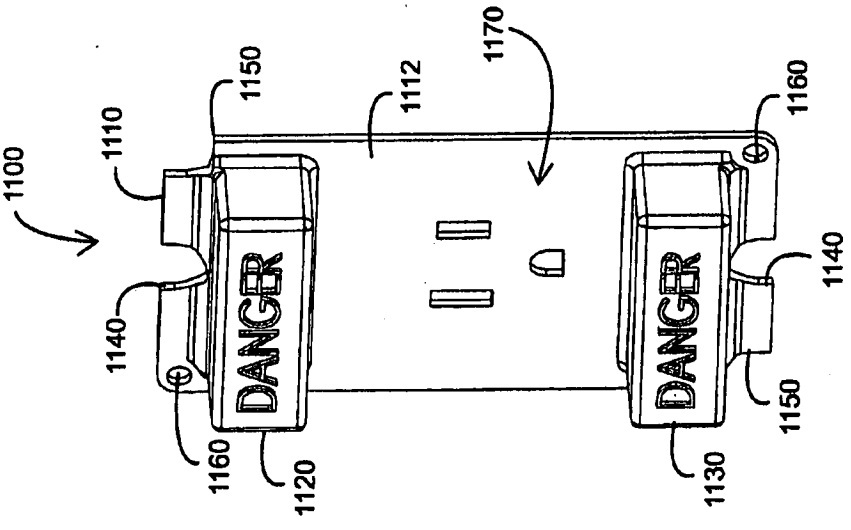
1100
1110
1150
1112
1170
1160
1140
1140
DANGER
DANGER
1160
1120
1150
1130

FIG. 11A

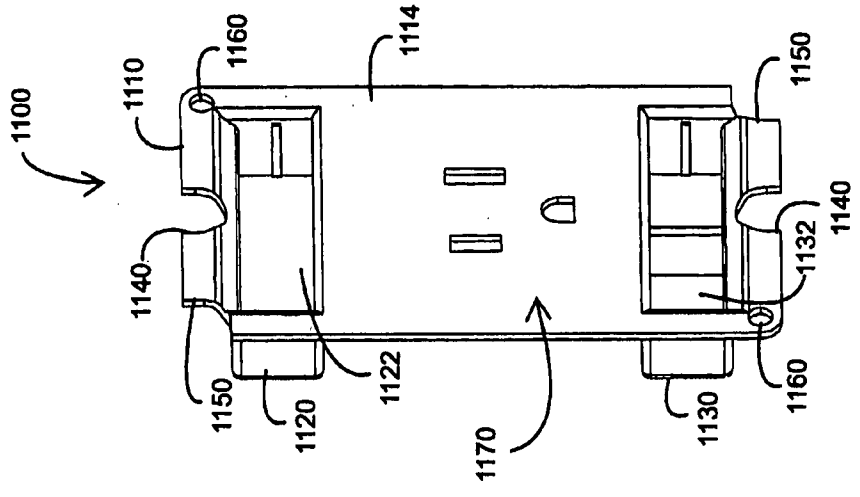
1100
1110
1160
1114
1150
1140
1132
1140
1150
1120
1122
1170
1130
1160

FIG. 11B

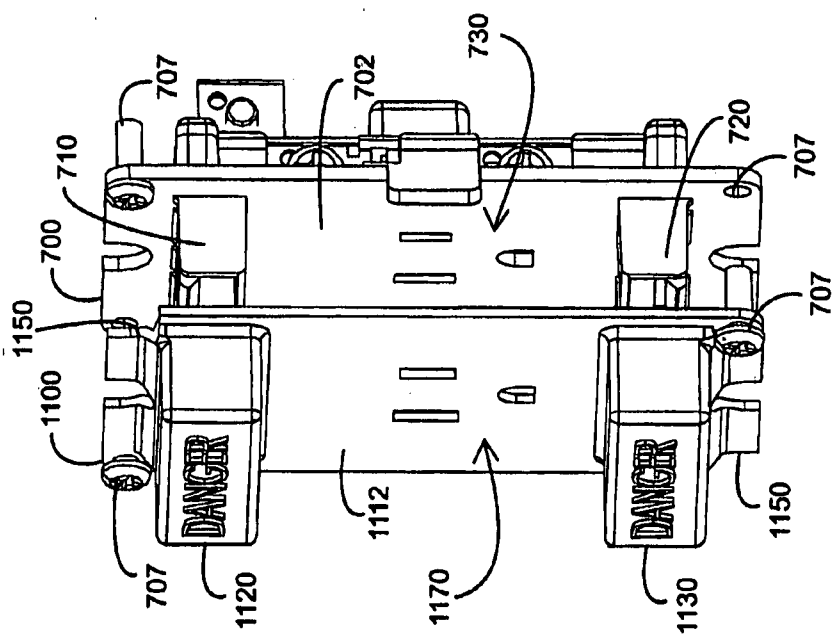
730
707
702
720
710
707
700
707
1150
1100
DANGER
DANGER
1112
1150
707
1120
1170
1130

FIG. 12

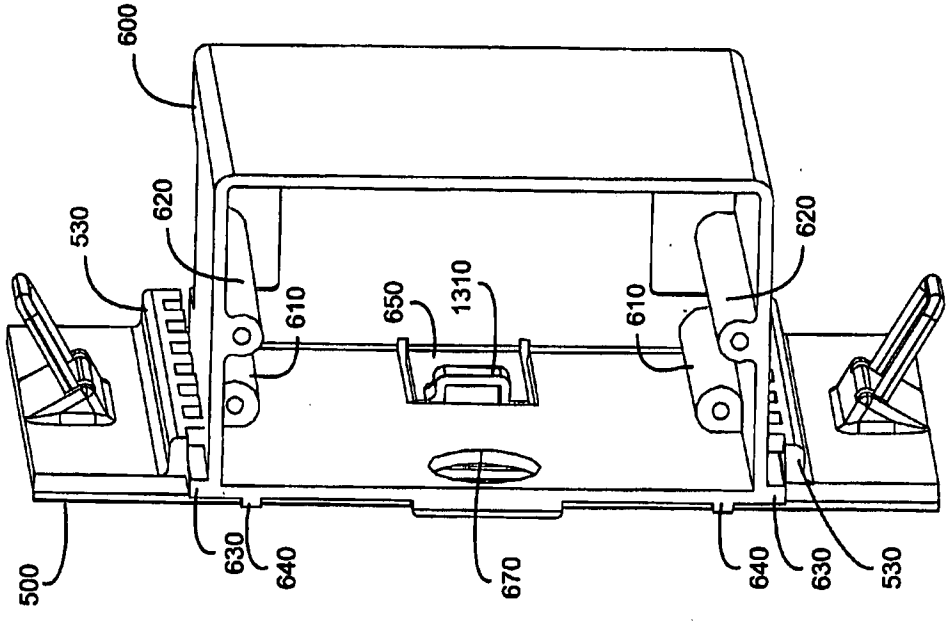

FIG. 13A

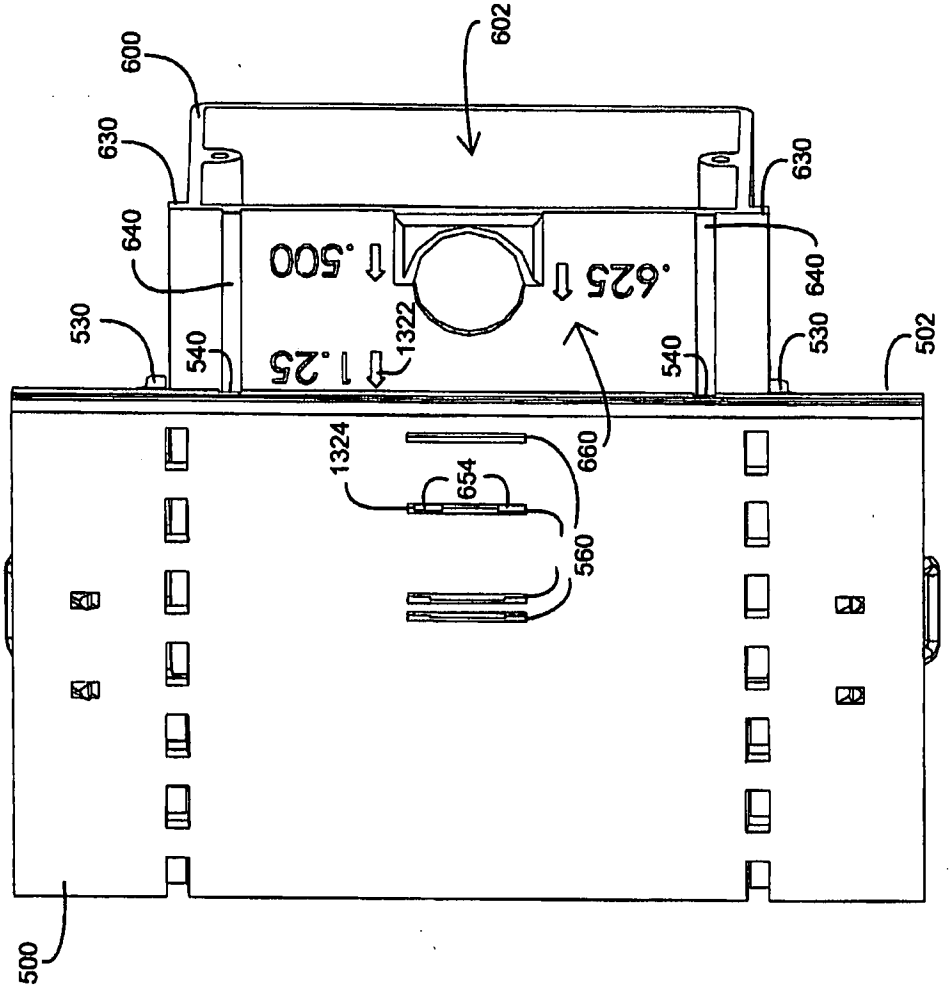
602
600
630
630
640
640
.500
.625
530
1.25
1322
530
540
540
502
1324
660
654
560
500

FIG. 13B

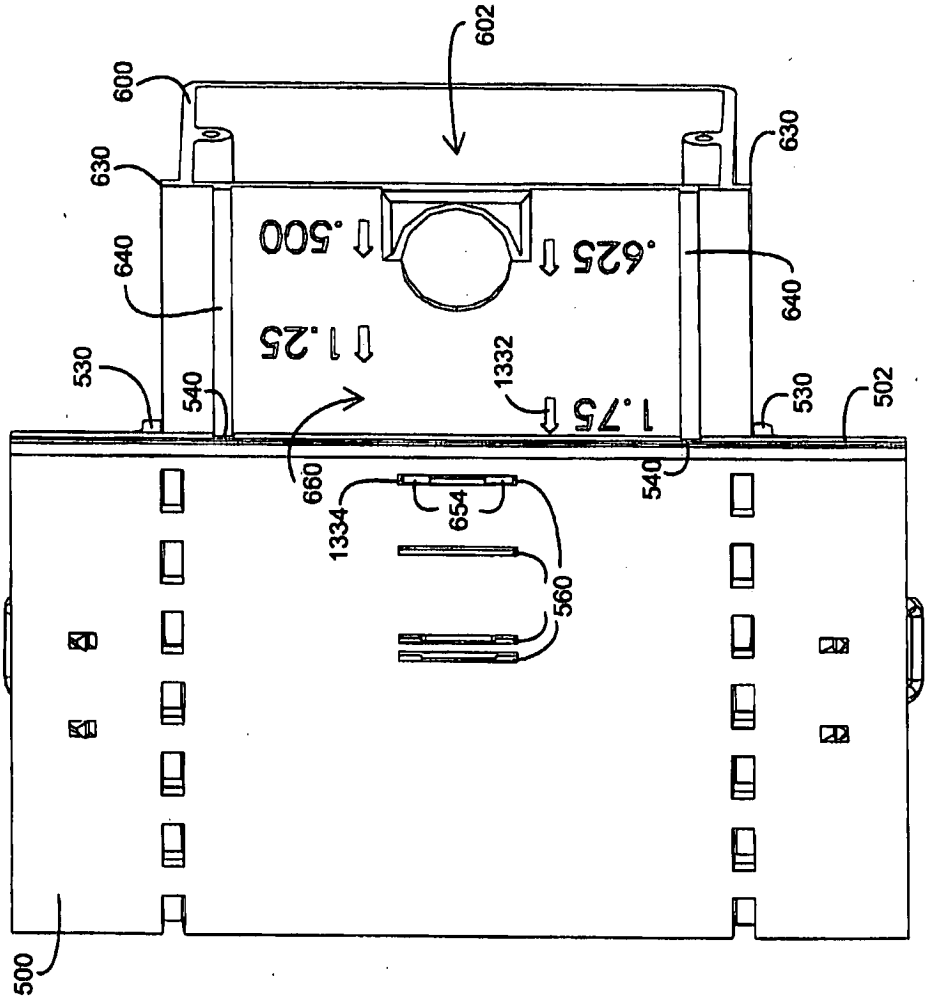
602
600
630
630
640
640
.500
.625
1.25
530
540
1332
1.75
530
502
660
654
1334
540
560
500

FIG. 13C

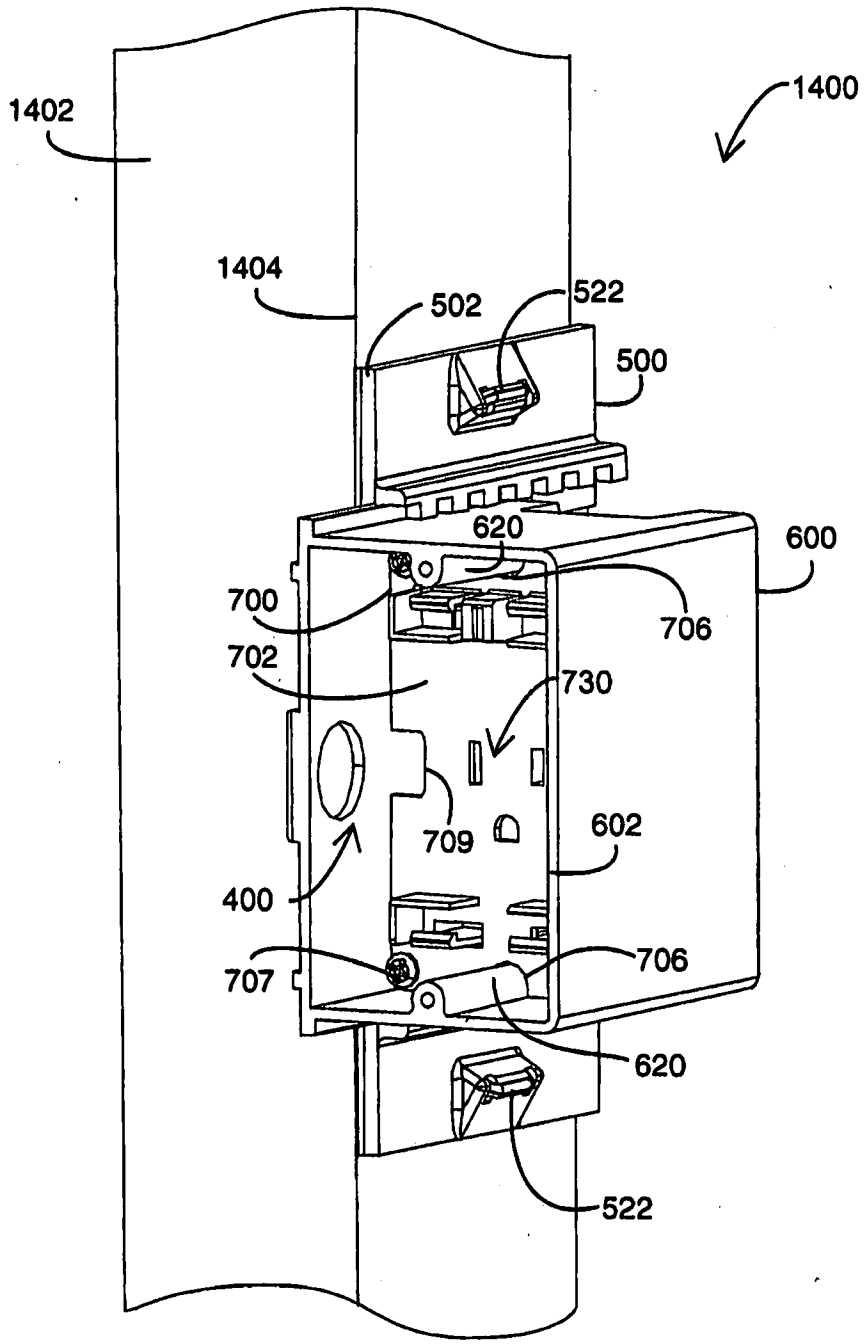
1402
1400
1404
502
522
500
620
600
700
706
702
730
709
602
400
707
706
620
522

FIG. 14A

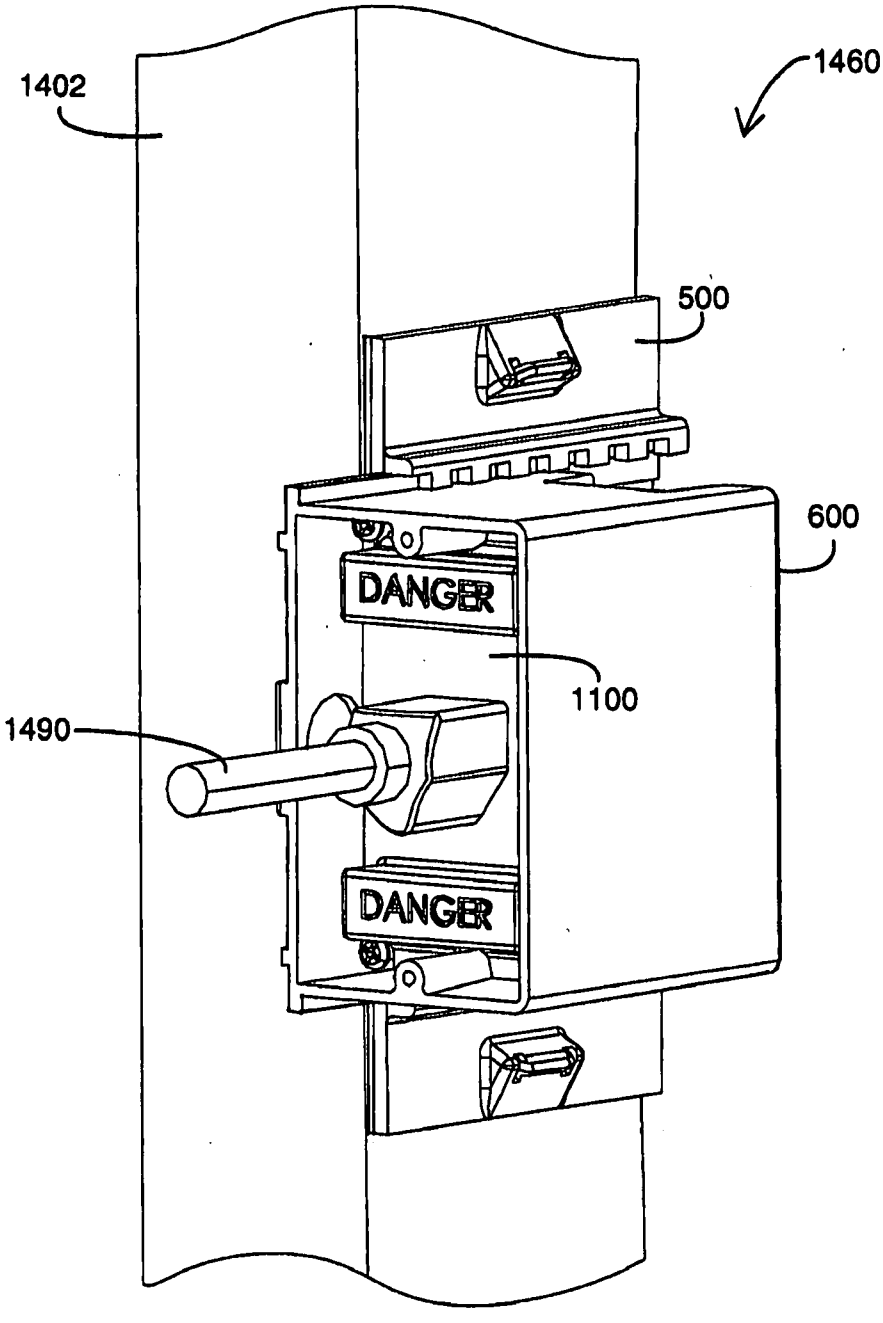

FIG. 14B

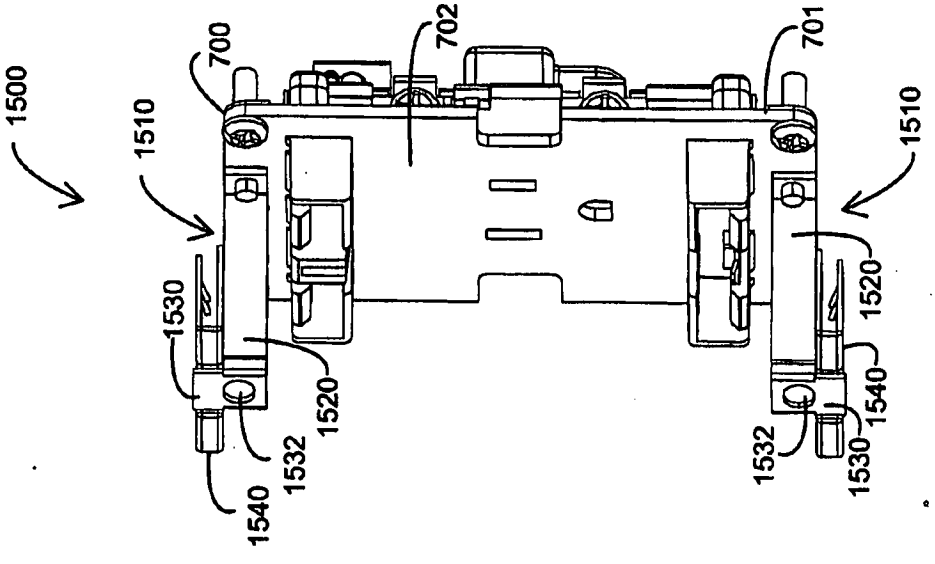
1500
1510
700
702
701
1510
1530
1520
1532
1540
1532
1530
1540
1520

FIG. 15

ELECTRICAL WIRING METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 10/685,294 filed Oct. 14, 2003 now abandoned, which is a continuation of U.S. patent application Ser. No. 10/023,393 filed Dec. 17, 2001, now abandoned, which is a divisional of U.S. patent application Ser. No. 09/553,425 filed Apr. 19, 2000, now U.S. Pat. No. 6,341,981 which relates to and claims the benefit of U.S. Provisional Patent Application No. 60/174,521 entitled Safety Electrical Wiring Assembly, filed Jan. 5, 2000. All of the above-referenced patent applications and patents are incorporated by reference herein.

BACKGROUND OF THE INVENTION

Installation of a standard AC electrical system in a new residence or commercial site occurs in three phases, corresponding to the building construction. The rough phase corresponds to rough framing of the building, prior to attachment of wall panels to the frame. During this phase, blue boxes or similar electrical boxes are mounted to wall studs at predetermined locations, so that outlets are 18" and switches are 36" from the floor. Various box types are available, such as single-, double-, triple- or quadruple-wide configurations, among others. After the boxes are installed, a journeyman electrician, following a predetermined layout, routes Romex® brand or equivalent power cables through the framing to the appropriate boxes. A typical power cable has two solid core insulated conductors and a ground conductor, all surrounded by a non-metallic sheath. The power cable is fed through openings in the rear or sides of the electrical boxes. The journeyman typically labels the conductors by writing a code on the insulation that indicates the wiring connectivity and the type of module to be installed in each box. Then these cables are folded back into the boxes, unterminated, so as to be out of the way until the next phase. After all of the electrical wiring is routed in this manner, the electrical subcontractors leave the construction site, waiting for other subcontractors to finish their tasks.

The makeup phase corresponds to wall panel installation and painting. During this phase, the journeyman returns to the construction site to install modules into the electrical boxes. The journeyman retrieves the cable from each box, reviews the labeling, and connects the cable conductors to the appropriate module. One module choice is a duplex outlet that receives standard two-prong or three-prong grounded AC plugs. The outlet can be wired full-hot, where each outlet is always connected to power, or half-hot, where one outlet is connected to power under control of a wall switch. Another module choice is a switch, which can be a standard on/off switch, a three-way switch or a dimmer switch, for example. After conductors are wired to a module, the module and attached conductors are pushed into the electrical box and the module is attached to the top and bottom of the box with screws. Once all modules are installed, the general contractor verifies the dwelling wiring against the electrical plans. If all of the wiring is correct, power can be connected to the dwelling for the first time.

The final phase corresponds to construction trimming and finishing work. During the trim phase, face plates are mounted over the open-end of the electrical boxes, completing the standard electrical wiring process.

SUMMARY OF THE INVENTION

Problems with Standard Wiring Construction

There are multiple problems with standard electrical wiring construction. From the electrical contractor perspective, there are unnecessary costs associated with installation. Two separate trips are required for each job site, one for the rough phase and one for the makeup phase. Further, a journeyman electrician is required for each phase. During the makeup phase, installation of the wall panels can damage the work completed during the rough phase. One way in which damage occurs is router contact with exposed cables when drywallers create a hole to accommodate electrical box openings. Another form of damage occurs when drywall compound or paint fouls the exposed cables, insulation and labeling.

From the general contractor perspective, there are other problems with the standard electrical wiring construction. Verification of the electrical contractor's work is not possible until after the makeup phase. Until then, the electrical cables are unterminated. After the makeup phase, however, miswiring typically requires cutouts in the installed wall panels and associated patches after corrections are completed. Further, the electrical system cannot be activated until after verification. Thus, during the rough and makeup phases, electricity for tools and lighting must be supplied by generators, which create hazards due to fumes, fuel, and noise and are an unreliable electrical source. In addition, until the trim phase is completed, unskilled personnel have access to the electrical cable. Tampering can comprise the integrity of the electrical wiring and also create a safety problem after power is activated.

From a homeowner's perspective, there are problems with repair of the standard electrical wiring. FIG. **1** illustrates a prior art electrical wiring assembly **100**, which includes a standard electrical box **110** and a standard duplex outlet **120**. Replacement of a broken outlet **120** first requires removal of a face plate (not shown). The screws **130** that attach the outlet **120** to the top and bottom of the electrical box **110** must be removed next. The outlet **120** is then removed from the box **110** and the conductors **140** are removed by loosing the screws **150** on the outlet sides. The process is then reversed to attach the conductors **140** to a new outlet **120** and mount the new outlet **120** into the electrical box **110**.

The prior art outlet replacement procédure described above exposes the homeowner to AC wiring upon removal of the face plate. This exposure creates a shock hazard. Further, a homeowner's reluctance to change out broken outlets or to spend the money to hire an electrician also creates a shock and a fire hazard from continued use of cracked, broken or excessively worn outlets. In addition, the integrity of the original wiring becomes questionable if a homeowner or other third party removes and replaces an outlet or switch. Miswiring by a third party can violate building codes and create shock and fire hazards, such as inadvertently switching the hot and neutral conductors, failing to attach ground wires, kinking or nicking conductors and improperly tightening connections.

Benefits of the System

The safety electrical outlet and switch system benefits the electrical contractor in several respects. An aspect of the system is an electrical box, a wiring panel installed internally to the box and associated outlet and switch modules which snap into and out of the panel without exposure to or access to electrical system wiring attached behind the panel. The journeyman's work is completed at the rough phase,

when installation of the wiring panel is complete. Thus, there is no need for the journeyman to return to the job site during the makeup phase because any semi-skilled laborer, following a punch-out code or other indicator on the panel, can snap-in an appropriate outlet or switch module. Further, there is no wiring access after the rough phase, protecting wiring integrity. Also, there are no exposed conductors or parts inside the electrical box that can be inadvertently damaged during wall panel installation. A protective cover is provided that prevents fouling by drywall compound or other materials during the makeup phase.

The safety electrical outlet and switch system also benefits the general contractor. Because wiring is completed during rough framing, verification and activation of the building electrical system can be performed at the rough phase. Miswiring can be corrected before wall panels are installed and painted, eliminating cut and patch repairs. Early electrical system activation eliminates the need to use generators. Lack of third party access to the journeyman's wiring preserves integrity after verification and eliminates shock exposure to other workers.

The system also benefits the homeowner. Replacement of broken sockets and switches can be easily and safely accomplished. Safety is enhanced by reducing exposure to electrical wiring and encouraging replacement of defective outlets and switches. Further, maintenance costs are reduced by reducing the need to hire an electrician for repairs. Wiring integrity is insured by reducing the opportunity of unqualified third parties to access the electrical system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a prior art outlet electrical wiring assembly;

FIG. **2** is a perspective view of a safety electrical outlet and switch system;

FIGS. **3**A-B are exploded perspective views of an outlet assembly and a switch assembly, respectively, of the safety electrical outlet and switch system, illustrating box mount, electrical box, wiring panel, snap-in electrical modules and face plate portions;

FIGS. **4**A-F are perspective views illustrating the removal and installation of snap-in electrical modules;

FIG. **4**A is a front perspective view of an installed snap-in outlet module;

FIG. **4**B is a front perspective view of an unfastened snap-in outlet module with extended extractor handles;

FIG. **4**C is a front perspective view of an uninstalled snap-in outlet module;

FIG. **4**D is a front perspective view of an uninstalled snap-in switch module;

FIG. **4**E is a front perspective view of an outlet module installed in a wiring panel;

FIG. **4**F is a front perspective view of a switch module installed in a wiring panel;

FIGS. **5**A-B are front and back perspective views, respectively, of a box mount;

FIGS. **6**A-B are front and back perspective views, respectively, of an electrical box;

FIGS. **7**A-F are perspective views of a wiring panel;

FIGS. **7**A-B are front and back perspective views, respectively, of an assembled wiring panel;

FIG. **7**C is a back perspective view of a wiring panel board;

FIG. **7**D is a front perspective view of a wiring panel back cover;

FIGS. **7**E-F are back and front perspective views, respectively, of wiring panel internal conductors;

FIGS. **8**A-F are perspective views of an outlet module;

FIGS. **8**A-B are front and back perspective views, respectively, of an assembled outlet module;

FIG. **8**C is a front perspective view of a mounting bracket;

FIG. **8**D is a back perspective view of an outlet module front cover;

FIG. **8**E is a front perspective view of an outlet module back cover;

FIGS. **8**F-G are back and front perspective views, respectively, of outlet module internal conductors;

FIGS. **9**A-F are perspective views of a switch module;

FIGS. **9**A-B are front and back perspective views, respectively, of an assembled switch module;

FIG. **9**C is a back perspective view of a switch module front cover;

FIG. **9**D is a front perspective view of a switch module back cover;

FIGS. **9**E-F are back and front perspective views, respectively, of switch module internal conductors;

FIGS. **10**A-D are perspective views of snap-on face plates;

FIGS. **10**A-B are front and back perspective views of a flared rectangular face plate;

FIG. **10**C is a front perspective view of a rectangular face plate;

FIG. **10**D is a front perspective view of an oval face plate;

FIGS. **11**A-B are front and back perspective views, respectively, of a protective cover;

FIG. **12** is a front perspective view of a protective cover and a wiring panel illustrating installation of the protective cover over the wiring panel;

FIGS. **13**A-C are front perspective views of a mounted electrical box;

FIG. **13**A is a electrical-box-side front perspective view of a mounted electrical box illustrating the releasable latch inside the box;

FIGS. **13**B-C are mounting-bracket-side front perspective views of a mounted electrical box, illustrating the box in first and second positions, respectively, relative to the box mount;

FIGS. **14**A-B are front perspective views of a mounted electrical box and associated components installed on a wall stud;

FIG. **14**A is a perspective view of a mounted electrical box with an installed wiring panel, illustrating box mount alignment;

FIG. **14**B is a perspective view of a mounted electrical box with an installed protective cover illustrating plug accessibility to electrical power during the rough framing phase of construction; and

FIG. **15** is a front perspective view of an adapter wiring panel.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

System Overview

FIG. **2** illustrates one embodiment of an installed safety electrical outlet and switch system **200**. As shown in FIG. **2**, the outlet and switch system **200** comprises a outlet assembly **310** and a switch assembly **360**. Each of these assemblies **310, 360** provide a user-accessible electrical function. The outlet assembly **310** is mounted in a wall **210** and functions to supply a user with electrical power through a conven-

tional AC plug inserted into an outlet module **800**. The switch assembly **360** is also mounted in the wall **210** and functions to allow a user to control electrical power to an outlet, a light or any of various electrical devices (not shown) by actuating a switch module **900**. The installed outlet assembly **310** includes a face plate **1000** and an outlet module **800** mounted so that its visible portion is generally flush with the face plate **1000**. The installed switch assembly **360** includes a face plate **1000** and a switch module **900** mounted so that its visible portion is in a plane generally parallel with the face plate **1000**. The face plates **1000** are interchangeable between the outlet assembly **310** and switch assembly **360** and include a flared rectangular face plate, a rectangular face plate and an oval face plate, as described with respect to FIGS. **10**A-D, below. Conveniently, the face plates **1000** attach to or are removed from the outlet assembly **310** or switch assembly **360** without the need for separate fastening devices, such as screws, and associated tools, as described with respect to FIG. **10**B, below.

FIGS. **3**A-B illustrate embodiments of a safety electrical outlet and switch system, comprising an outlet assembly **310** (FIG. **3**A) and a switch assembly **360** (FIG. **3**B). As shown in FIG. **3**A, an outlet assembly **310** comprises a box mount **500**, an electrical box **600**, a wiring panel **700**, an outlet module **800** and a face plate **1000**. As shown in FIG. **3**B, a switch assembly **360** comprises a box mount **500**, an electrical box **600**, a wiring panel **700**, a switch module **900** and a face plate **1000**. The box mount **500**, electrical box **600**, wiring panel **700**, outlet module **800** (FIG. **3**A), switch module **900** (FIG. **3**B), and face plate **1000** are described in detail below with respect to FIGS. **5**A-B, **6**A-B, **7**A-F, **8**A-G, **9**A-F and **10**A-D, respectively. In one embodiment, the main structural components of the box mount **500**, electrical box **600**, wiring panel **700**, outlet module **800**, switch module **900**, face plate **1000** and protective cover **1100** (FIG. **11**) are composed of thermoplastics, such as nylon, polycarbonate or ABS. In that embodiment, the conductive components of the wiring panel **700**, outlet module **800** and switch module **900** are brass or copper alloys. One of ordinary skill in the art will recognize that other materials can be used for the structural and conductive components of the system.

FIGS. **4**A-F illustrate removal and installation of a snap-in outlet module **800** (FIG. **4**C) or a snap-in switch module **900** (FIG. **4**D). FIG. **4**A shows an installed outlet assembly **310** with the face plate **1000** (FIG. **3**A) removed. An outlet module **800** is removably attached to the wiring panel **700** (FIG. **4**C) and secured with fasteners **809** to the electrical box **600**.

FIG. **4**B shows the outlet module **800** during removal from, or installation into, the electrical box **600**. During removal, the fasteners **809** are unfastened to release the outlet module **800** from the electrical box **600** and extend the extractor handles **824**, as shown. The extended extractor handles **824** are manually gripped and pulled to unsnap the outlet module **800** from the wiring panel **700** (FIG. **4**C). The outlet module **800** is then removed from electrical box **600**, as shown in FIG. **4**C. During installation, the process is reversed. The extended extractor handles **824** are pushed into the outlet module **800**, and the outlet module **800** is secured to the electrical box **600**, as shown in FIG. **4**A, using the fasteners **809** to attach to the module mounting posts **620** (FIG. **4**C)

FIG. **4**C shows an outlet module **800** during installation into or removal from the electrical box **600**. For installation, the outlet module **800** is placed at the electrical box open front face **602**, as shown. The outlet module **800** is then inserted into the module compartment **400** interior to the electrical box **600** between the front face **602** and the wiring panel **700**. The top module fixture **830** and bottom module fixture **840** engage the top panel fixture **710** and bottom panel fixture **720**, respectively. The outlet module **800** is then pressed against the wiring panel **700**, which snaps the outlet module **800** into the wiring panel **700**, electrically connecting the outlet module **800** and wiring panel **700**. The outlet module **800** is then secured to the electrical box **600**, as described above with respect to FIG. **4**B.

FIG. **4**D shows a switch module **900** during installation into or removal from the electrical box **600**. For installation, the switch module **900** is placed at the electrical box front face **602**, as shown. The switch module **900** is then inserted into the module compartment **400** interior to the electrical box **600**. The top module fixture **930** and bottom module fixture **940** engage the top panel fixture **710** and bottom panel fixture **720**, respectively. The switch module **900** is then pressed against the wiring panel **700**, which snaps the switch module **900** into the wiring panel **700**, electrically connecting the switch module **900** and wiring panel **700**. The switch module **900** is then secured to the electrical box **600**, in a manner similar to that described above with respect to FIG. **4**B.

FIG. **4**E shows the outlet module **800** installed into the wiring panel **700**. The outlet module back cover **804** faces the wiring panel front side **702**. The wiring panel top guides **712** fit within the outlet module top slots **834**, and the wiring panel bottom guides **722** fit within the outlet module bottom slots **844**.

FIG. **4**F shows the switch module **900** installed into the wiring panel **700**. The switch module back cover **904** faces the wiring panel front side **702**. The wiring panel top guides **712** fit within the switch module top slots **934**, and the wiring panel bottom guides **722** fit within the switch module bottom slots **944**.

Box Mount

FIGS. **5**A-B show a box mount **500**, which attaches to a framing stud and provides a slidable attachment for the electrical box **600** (FIGS. **6**A-B). As shown in FIG. **5**A, the box mount **500** has a stud plate **510**, fastener holders **520**, mounting brackets **530**, grooves **540**, a latch channel **550** and catch slots **560**. The stud plate **510** has a box side **512**, a stud side **518** (FIG. **5**B), and a leading edge **502** that functions as a stud alignment guide. The fastener holders **520** receive and retain fasteners **522**, such as staples as shown. The box mount **500** is attached to a wall stud with the stud side **518** flush against the stud and with the leading edge **502** aligned with a stud edge. The fasteners **522** are hammered or otherwise driven into the stud through apertures **570** (FIG. **5**B) on the stud side **518** (FIG. **5**B). Attachment of the box mount to a wall stud is described in further detail with respect to FIG. **14**A, below. The electrical box **600** (FIGS. **6**A-B) is attached to the box mount **500** by placing the electrical box **600** (FIGS. **6**A-B) adjacent the area between the mounting brackets **530**, with the latch **650** (FIGS. **6**A-B) adjacent the channel **550**. The slides **630** (FIGS. **6**A-B) are inserted into the mounting brackets **530** and the guides **640** (FIGS. **6**A-B) into the grooves **540**, as described in further detail with respect to FIG. **13**A, below. The catch slots **560** removably retain the electrical box **600** (FIGS. **6**A-B) at various fixed positions, as described in further detail with respect to FIGS. **13**B-C, below.

Electrical Box

FIGS. **6**A-B illustrate an electrical box **600**. The electrical box **600** has outer dimensions generally consistent with

conventional electrical boxes. The electrical box **600** has an open front face **602** and a back face **604**. As shown in FIGS. **6**A-B, the electrical box **600** has a mounting side **606** and an opposite gripping side **608**. The mounting side **606** has slides **630**, guides **640**, a latch **650**, position indicators **660**, a finger grip **670** and apertures **680**. The slides **630** and guides **640** mate with corresponding brackets **530** (FIG. **5**A) and grooves **540** (FIG. **5**A) on the box mount **500** (FIGS. **5**A-B), as described with respect to FIG. **13**A, below. The latch **650** has a spring portion **652** and a tab portion **654**. The spring portion **652** is attached to the electrical box **600** along the back face **604** and extends along the mounting side **606**, terminating with the tab portion **654**. The tab portion **654** extends from the spring portion **652** generally perpendicularly to the mounting side **606**, away from the electrical box **600**. When the electrical box **600** is attached to the box mount **500** (FIGS. **5**A-B), the catch **654** is configured to engage in any of the catch slots **560** (FIGS. **5**A-B). The finger grip **670** is utilized to manually grip and position the electrical box **600** relative to the box mount **500** (FIGS. **5**A-B) according to the position indicators **660**, as described in further detail with respect to FIGS. **13**B-C, below. The apertures **680** are located on the back face **604** for routing power cable through the back face **604** and into the interior of the electrical box **600**. In another embodiment, a center aperture (not shown) is included, also for routing power cable into the interior of the electrical box **600**.

As shown in FIGS. **6**A-B, the front face **602** and interior of the electrical box **600** are configured for installment of the wiring panel **700** (FIGS. **7**A-B), the protective cover **1100** (FIGS. **11**A-B), the outlet module **800** (FIGS. **8**A-B) and the switch module **900** (FIGS. **9**A-B). The interior of the electrical box **600** includes panel mounting posts **610** located along each interior corner edge and module mounting posts **620** located along the center of the interior top and bottom faces. Each of the panel mounting posts **610** is recessed from the front face **602** and has a centered hole **612**. In one embodiment, the panel mounting posts **610** are recessed at least about 1.25 inches from the front face **602** to avoid damage to the installed wiring panel **700** (FIGS. **7**A-B) during the makeup phase of construction and, in particular, during wall panel installation. Each of the module mounting posts **620** is flush with the front face **602** and has a centered hole **622**.

The wiring panel **700** (FIGS. **7**A-B) is installed in the interior of the electrical box **600** with panel back side **704** (FIG. **7**B) abutting the panel mounting posts **340**. The wiring panel **700** (FIGS. **7**A-B) is secured within the electrical box **600** with fasteners **707** (FIG. **7**C) threaded or otherwise inserted into the centered holes **612**, as described with respect to FIG. **14**A, below. Similarly, the protective cover **1100** (FIGS. **11**A-B) is installed in the interior of the electrical box **600** against the panel mounting posts **340** and secured with fasteners **707** (FIG. **12**) inserted through the centered holes **612**, as described with respect to FIG. **14**B, below. The outlet module **800** (FIGS. **8**A-B) and the switch module **900** (FIGS. **9**A-B) are snapped into the wiring panel **700** (FIGS. **7**A-D) and secured to the module mounting posts **620** with the fasteners **809** (FIGS. **4**A-D) threaded or otherwise inserted into centered holes **622**, as described with respect to FIGS. **4**A-D, above.

Wiring Panel

FIGS. **7**A-F illustrate the generally planar wiring panel **700**, which has a board **701**, internal conductors **703**, a back cover **705** and fasteners **707**. The board **701** (FIG. **7**C) retains the internal conductors **703** (FIGS. **7**E-F), the back cover **705** (FIG. **7**D) and the fasteners **707** (FIG. **7**C) of the assembled wiring panel **700** (FIGS. **7**A-B). FIGS. **7**A-B illustrate the assembled wiring panel **700**.

As shown in FIGS. **7**A-B, the wiring panel **700** has a front side **702** and a back side **704**. As shown in FIG. **7**A, the front side **702** has a top panel fixture **710**, a bottom panel fixture **720** and a socket **730**. The top panel fixture **710** and bottom panel fixture **720** are configured to accept, removably retain and electrically connect to an outlet module **800** (FIGS. **8**A-B), a switch module **900** (FIGS. **9**A-B) or similar module that provides a user-accessible electrical function. The top panel fixture **710** has top guides **712**, top latches **714**, top panel contacts **756**, **766** and a ground connector **718**, all extending in a direction normal to the front side **702**. A ground panel contact **776** (FIG. **7**F) is accessible through the ground connector **718**. The bottom panel fixture **720** has bottom guides **722**, bottom latches **724** and bottom panel contacts **757**, **767**, also all extending in a direction normal to the front side **702**.

Also shown in FIG. **7**A, the socket **730** has a hot slot **732**, a neutral slot **734** and a ground hole **736**. The socket **730** is configured to accept and electrically connect to a standard plug, which is inserted into the socket **730** so that the plug's hot prong, neutral prong and ground post enters the hot slot **732**, neutral slot **734** and ground hole **736**, respectively, and electrically connects with the hot socket contact **758** (FIGS. **7**E-F), neutral socket contact **768** (FIGS. **7**E-F) and ground socket contact **778** (FIGS. **7**E-F), respectively.

One particularly advantageous feature of the wiring panel **700** is the socket **730**. The socket **730** allows power to be supplied to a construction crew after the wiring panel **700** has been wired and building electrical system tested and activated, prior to the makeup phase, as described in further detail with respect to FIGS. **14**A-B, below. Another particularly advantageous feature is that a user's exposure to the top panel contacts **756**, **766** is minimized by the top guides **712**, top latches **714** and ground connector **718** that shield the top panel contacts **756**, **766** on all four sides and the front. Further, the ground connector **718** separates the first top panel contact **756** from the second top panel contact **766**, reducing the possibility of a short between the top panel contacts **756**, **766**. Similarly, the bottom guides **722** and bottom latches **724** shield the bottom panel contacts **757**, **767** from the sides and the front.

As shown in FIG. **7**B, the wiring panel back side **704** has a back cover **705**, first buss cable connectors **752**, **754**, second buss cable connectors **762**, **764** and a ground buss cable connector **772**. A first buss breakaway **755** can be removed during wiring of the wiring panel **700** in order to isolate the first buss top cable connector **752** from the first buss bottom cable connector **754**. Similarly, a second buss breakaway **755** can be removed in order to isolate the second buss top cable connector **762** from the second buss bottom cable connector **764**. During installation of the wiring panel **700** into the electrical box **600** (FIGS. **6**A-B), described with respect to FIG. **14**A, below, one or more electrical cables, such as power or equivalent, are routed through the electrical box apertures **680** and the wires within the cables are attached to the cable connectors **752**, **754**, **762**, **764**. The wire connections are made by hooking an uninsulated conductor portion of the wires around the respective screws of the cable connectors **752**, **754**, **762**, **764** and tightening the screws so that the conductors are secured between the screws and their respective busses **750**, **760**, **770** (FIGS. **7**E-F), as is well-known in the art. The particular wiring configuration is a function of a master wiring plan for the building under construction and the module type to be

installed in the wiring panel **700**. Several wiring panel **700** wiring configurations are described below.

FIG. **7C** illustrates the back side **704** of the wiring panel board **701**, which has mounting post slots **706**, mounting holes **708** and grips **709**. These features are used to install the wiring panel **700** and secure it with fasteners **707** within the electrical box **600** (FIGS. **6A-B**), as described with respect to FIG. **14A**, below. The wiring panel board **701** also has raised chambers **782, 784, 786** that retain the internal conductors **703** (FIGS. **7E-F**) and binding sockets **781**.

FIG. **7D** illustrates the front of the wiring panel back cover **705**. The back cover **705** has a connector aperture **792** that accommodates the ground buss cable connector **772** (FIG. **7B**), prong apertures **794, 796** that accommodate the prongs of a standard plug inserted into the wiring panel socket **730** (FIG. **7A**), and a ground post aperture **798** that accommodates the ground post of the inserted standard plug. Binding posts **791** press-fit into corresponding binding sockets **781** (FIG. **7C**) on the panel back side **704** (FIG. **7C**) for joining the back cover **705** to the wiring panel board **701** (FIG. **7C**).

As shown in FIGS. **7E-F**, the internal conductors **703** include a first buss **750**, a second buss **760** and a ground buss **770**. The busses **750, 760, 770** are retained within the wiring panel board raised chambers **782, 784, 786**, respectively. The first buss **750** electrically connects the first top panel contact **756**, the first buss top cable connector **752**, the first buss breakaway **755**, the first bottom panel contact **757**, the first buss bottom cable connector **754** and the hot socket contact **758**. Similarly, the second buss **760** electrically connects the second top panel contact **766**, the second buss top cable connector **762**, the second buss breakaway **765**, the second bottom panel contact **767**, the second buss bottom cable connector **764** and the neutral socket contact **768**. The ground buss **770** electrically connects the ground panel contact **776**, the ground buss cable connector **772** and the socket ground contact **778**. If the first buss breakaway **755** is removed, the first top panel contact **756** and the first buss top cable connector **752** are electrically isolated from the first bottom panel contact **757**, the first buss bottom cable connector **754** and the hot socket contact **758**. Likewise, if the second buss breakaway **765** is removed, the second top panel contact **766** and the second buss top cable connector **762** are electrically isolated from the second bottom panel contact **767**, the second buss bottom cable connector **764** and the neutral socket contact **768**. The panel contacts **756, 766, 757, 767** provide contact surfaces for electrical connection to outlet module contacts **856, 866, 857, 867** or switch module contacts **956, 966, 957, 967** as described with respect to FIGS. **8F-G** and FIGS. **9E-F**, below.

Outlet Module

FIGS. **8A-G** illustrate an outlet module **800**, which has a front cover **802**, an attachment assembly **820**, a back cover **804** and internal conductors **806**. FIGS. **8A-B** illustrate an assembled outlet module **800**, FIG. **8C** illustrates the front of the attachment assembly **820**, FIG. **8D** illustrates the back of the outlet module front cover **802**, FIG. **8E** illustrates the front of the outlet module back cover **804**, and FIGS. **8F-G** illustrate the outlet module internal conductors **806**. As shown in FIG. **8A**, the front cover **802** and back cover **804** are glued, welded or otherwise attached together to form the body of the outlet module **800**. The attachment assembly **820** is retained by the front cover **802**, as described with respect to FIG. **8C**, below, and provides the means to secure the outlet module **800** to an electrical box **600** (FIGS. **6A-B**). The front cover **802** has a raised socket portion **810**, which includes a top socket **811** and

tom socket **816**, each

compatible with a standard AC The top socket **811** has

a hot slot **812**, a neutral slot **81** ground post hole **814**,

which provide plug access to p socket contacts **854**,

864, 874 (FIGS. **8F-G**). Simila bottom socket **816** has

a hot slot **817**, a neutral slot **81** a ground post hole **819**,

which provide plug access to ottom socket contacts

855, 865, 875 (FIGS. **8F-G**).

As shown in FIG. **8B**, the b ver **804** includes a top

module fixture **830** and a botto ule fixture **840**. The top

module fixture **830** includes to tact housings **832** and

top slots **834**. The bottom m fixture **840** includes

bottom contact housings **842** om slots **844**, and a

module key **846**. The top conta sings **832** contain top

outlet contacts **856, 866**, and t ttom contact housings

842 contain bottom outlet cont **57, 867**. A ground bar

876 extends from the back c **804** between the top

contact housings **832**.

As shown in FIG. **8C**, the hment assembly **820**

includes a bracket **822** and e r handles **824**. The

bracket **822** is a one-piece co ive element that fits

around the outside of the front **802**. The sides of the

front cover **802** (FIG. **8D**) inclu truding cover catches

803 (FIG. **8D**) that extend throug ket slots **823** to retain

the attachment assembly **820** and ain a cover plate **1000**

(FIGS. **10A-D**), as described espect to FIG. **10B**,

below. The extractor handles **82** moveably retained by

the bracket **822**, and each handle as a crossbar **826** and

arms **828**. At the tip of each han n **828** is a clasp **829**.

In the center of each handle cros 26 is a fastener hole

827. A fastener **809**, such as w or equivalent, is

moveably retained within the fas hole **827**. The extrac-

tor handles **824** each have a clos ition, shown at the top

of FIG. **8C**, and an open positi own at the bottom of

FIG. **8C**. In the closed position andles **824** are pushed

in so that the crossbar **826** fits a the bracket **822**. In the

open position, the handles **82** pulled out so that they

extend away from the bracket with the arm clasps **829**

each clasping an edge portio e bracket **822**. With the

handles **824** in the closed pos he outlet module can be

secured to an electrical box 6 GS. **6A-B**), as described

with respect to FIG. **4A**, abo th the handles **824** in the

open position, the outlet m can be removed from a

wiring panel **700** (FIGS. **7A** described with respect to

FIGS. **4B-C**, above.

As shown in FIG. **8D**, t nt cover **802** has binding

posts **883** that press-fit int esponding binding sockets

893 (FIG. **8E**) on the back **804** (FIG. **8E**) for joining

the front cover **802** and ba er **804** (FIG. **8E**). The front

cover **802** also has a ra ortion **881** that retains the

ground buss **870** (FIGS.) and the adjacent top and

bottom busses **851, 852**, 62 (FIGS. **8F-G**).

As shown in FIG. **8E**, t k cover **804** has top recessed

portions **891** within the t tact housings **832** that retain

the top outlet contacts **85** (FIGS. **8F-G**). Similarly, the

back cover **804** has botto essed portions **892** within the

bottom contact housings hat retain the bottom outlet

contacts **857, 867** (FIGS).

As shown in FIGS. **8F** e internal conductors **806** of

the outlet module **800** in a top hot buss **851**, a bottom

hot buss **852**, a top neutr s **861**, a bottom neutral buss

862, and a ground buss **8** he top hot buss **851** has a top

socket hot contact **854** top hot module contact **856**.

The bottom hot buss **852** bottom socket hot contact **855**

and a bottom hot modul act **857**. The top neutral buss

861 has a top socket ne contact **864** and a top neutral

module contact **866**. T ttom neutral buss **862** has a

bottom socket neutral contact **865** and a bottom neutral module contact **867**. The ground buss **870** has a ground bar **876**, a top socket ground contact **874** and a bottom socket ground contact **875**.

Outlet Module Installation

In reference to FIG. **8**B, an outlet module **800** is installed in an electrical box **600** (FIGS. **6**A-B) as described with respect to FIGS. **4**A-C, E above. An outlet module **800** and the wiring panel **700** (FIGS. **7**A-B) are keyed to prevent the installation of an outlet module **800** into a module compartment **400** (FIG. **4**C) with an incorrect, i.e. upside-down orientation. Specifically, the module key **846** must engage the bottom panel fixture **720** (FIG. **7**A) and the ground bar **876** must engage the ground connector **718** (FIG. **7**A) for proper module orientation. The module key **846** will not engage the top panel fixture **710** (FIG. **7**A) and the ground bar **876** will not engage the bottom panel fixture **720** (FIG. **7**A) in the improper orientation. That is, the module key **846** and ground bar **876** function as keyed structures of the outlet module **800**, and the ground connector **718** (FIG. **7**A) and bottom panel fixture **720** (FIG. **7**A), in particular the gap between the guides and latches **722, 724** (FIG. **7**A), function as keyed structures of the wiring panel **700** (FIG. **7**A). The keyed structures of the outlet module **800** and the corresponding keyed structures of the wiring panel **700** (FIG. **7**A) insure proper orientation of the installed outlet module **800**.

In reference to FIGS. **8**F-G, when an outlet module **800** (FIGS. **8**A-B) is attached to a wiring panel **700** (FIGS. **7**A-B), the top hot module contact **856** is electrically connected to the first top panel contact **756** (FIGS. **7**E-F), the top neutral module contact **866** is electrically connected to the second top panel contact **766** (FIGS. **7**E-F), the bottom hot module contact **857** is electrically connected to the first bottom panel contact **757** (FIG. **7**E-F), and the bottom neutral module contact **867** is electrically connected to the second bottom panel contact **767** (FIGS. **7**E-F). In this configuration, if the wiring panel **700** (FIGS. **7**A-B) is wired in a full-hot configuration, as described below, then the top **851** and bottom **852** hot busses are hot, the top **861** and bottom **862** neutral busses are neutral and the ground buss **870** is grounded. In this manner, the top socket contacts **854, 864, 874** provide power to a standard AC plug inserted into the top socket **811** (FIG. **8**A) and the bottom socket contacts **855, 865, 875** provide power to a standard AC plug inserted into the bottom socket **816** (FIG. **8**A). Similarly, if the wiring panel **700** (FIGS. **7**A-B) is wired in a half-hot configuration, as described below, then a standard AC plug inserted into (typically) the bottom socket **816** (FIG. **8**A) is provided power and a standard plug inserted into (typically) the top socket **811** (FIG. **8**A) is provided switched power.

Also in reference to FIGS. **8**F-G, the outlet module contacts **856, 857, 866, 867** are spring contacts each extending from busses **851, 852, 861, 862** and each having a generally V-shaped contact point. During installation, as the outlet module **800** (FIGS. **8**A-B) is pressed against the wiring panel **700** (FIGS. **7**A-B) the top and bottom module contacts **856, 857, 866, 867** press against the corresponding top latches **714** (FIG. **7**A) and bottom latches **724** (FIG. **7**A). These latches **714, 724** (FIG. **7**A) are flexible, spring-like structures extending from the wiring panel board **701** (FIG. **7**A) and having a hooked tip. When sufficient pressing force is applied, the spring contacts **856, 857, 866, 867** and the spring latches **714, 724** (FIG. **7**A) flex until the contact points pass over and clear the hooked tips and connect with the contact surfaces of the panel contacts **756, 757, 766, 767** (FIG. **7**A), with the hooked tip latches **714, 724** retaining the V-shaped module contacts **856, 857, 866, 867**. At the instant the contact points pass over the latch tips, the contacts **856, 857, 866, 867** and latches **714, 724** (FIG. **7**A) quickly return to their unflexed positions with a mechanical action that is referred to herein as a snap, snapping or snap-in. A similar mechanical action occurs when the contacts **856, 857, 866, 867** and latches **714, 724** (FIG. **7**A) are disconnected and is referred to herein as an unsnap, unsnapping or snap-out.

The snapping and unsnapping of the outlet module during installation and removal creates positive tactile feedback that both a mechanical and electrical connection has been made between the outlet module **800** (FIGS. **8**A-B) and the wiring panel **700** (FIGS. **7**A-B). This is in contrast to a plug-in electrical connection, such as when the prongs of a standard AC plug are inserted into or removed from a standard socket, where the tactile feedback is that of slight, continual resistance to the movement of the plug rather than the build-up and quick release of resistance for the snap-in module installation into the module compartment **400** (FIG. **4**C) and attached to the wiring panel **700** (FIGS. **7**A-B) or the corresponding snap-out module removal.

Wiring Panel Outlet Module Wiring

In reference to FIG. **7**B, the wiring panel **700** is wired for a full-hot duplex outlet by connecting the black, white and green wires of a single power cable to, for example, the first buss bottom cable connector **754**, the second buss bottom cable connector **764**, and ground buss cable connector **772**, respectively. In this manner, both of the duplex sockets **811, 816** (FIG. **8**A) of an installed outlet module **800** (FIGS. **8**A-B) are always hot.

Also in reference to FIG. **7**B, the wiring panel **700** is wired for a half-hot duplex outlet by connecting the black and white wires of one power cable as described above. The black and white wires of a second power cable are connected to the top hot **752** and neutral **762** connectors, respectively. Break away portions **755, 765** of the hot buss **750** and neutral buss **760**, respectively, are removed, isolating the top hot connector **752** from the bottom hot connector **754** and the top neutral connector **762** from the bottom neutral connector **764**. This also isolates the top panel contacts **756, 766** (FIG. **7**A) from the bottom panel contacts **757, 767** (FIG. **7**A). In this manner, one of the duplex sockets **816** (FIG. **8**A) of an installed outlet module **800** is always hot and the other duplex socket **811** (FIG. **8**A) is on or off, as controlled by a nearby switch that routes power to the second power cable.

Switch Module

FIGS. **9**A-F illustrate a switch module **900**, which has a front cover **902**, a rocker switch **910**, an attachment assembly **820**, a back cover **904** and internal conductors **906**. FIGS. **9**A-B illustrate an assembled switch module **900**, FIG. **9**C illustrates the back of a switch module front cover **902**, FIG. **9**D illustrates the front of a switch module back cover **904**, and FIGS. **9**E-F illustrate the switch module internal conductors **906**. As shown in FIG. **9**A, the front cover **902** and back cover **904** are glued, welded or otherwise attached together to form the body of the switch module **900**. The attachment assembly **820** is retained by the front cover **802**, as described with respect to FIG. **8**C, above, and provides the means to secure the switch module **900** to an electrical box **600** (FIGS. **6**A-B). The front cover **902** incorporates a rocker switch **910**, which has an upper portion **912** with a raised button **913** and a lower portion **914** with an indented button **915**. The rocker switch **910** has a first position with the upper portion **912** proximate the front

cover **902**, as shown, and a second position with the lower portion **914** proximate the front cover **902**.

As shown in FIG. **9B**, the back cover **904** includes a top module fixture **930** and a bottom module fixture **940**. The top module fixture **930** includes top contact housings **932** and top slots **934**. The bottom module fixture **940** includes bottom contact housings **942**, bottom slots **944**, and a wiring panel key **946**. The top contact housings **932** contain top module contacts **956**, **966**, and the bottom contact housings **842** contain bottom module contacts **957**, **967**. A ground bar **976** extends from the back cover **904** between the top contact housings **932**.

As shown in FIG. **9C**, the front cover **902** has a binding post **984** that press-fits into a corresponding binding socket **994** (FIG. **9D**) on the back cover **904** (FIG. **9D**) and binding sockets **983** that accept back cover binding posts **993**, all for joining the front cover **902** and back cover **904** (FIG. **9D**). The front cover **902** also has a switch aperture **981** through which protrudes a lever portion **918** of the rocker switch **910**. The sides of the front cover **902** include protruding cover catches **903** that extend through bracket slots **823** (FIG. **8C**) to retain the attachment assembly **820** (FIGS. **9A-B**) and to retain a cover plate **1000** (FIGS. **10A-D**), in a manner similar to that described with respect to FIG. **8C**, above.

As shown in FIG. **9D**, the back cover **904** has top recessed portions **991** within the top contact housings **932** that retain the top module contacts **956**, **966** (FIGS. **9E-F**). Similarly, the back cover **904** has bottom recessed portions **992** within the bottom contact housings **942** that retain the bottom module contacts **957**, **967** (FIGS. **9E-F**). The back cover **904** also has carrier supports **998** for the carrier **960** (FIGS. **9E-F**), a buss support **997** for the second bottom buss **962** (FIGS. **9E-F**), a support **996** for the top upper throw contact **967** (FIGS. **9E-F**), as well as other raised structures (not shown) for supporting the first bottom buss **952** (FIGS. **9E-F**) and the first top buss **951** (FIGS. **9E-F**). A spring aperture **999** retains the slide spring **925** (FIG. **9E**).

As shown in FIGS. **9E-F**, the switch module internal conductors **906** include a first top buss **951**, a second top buss **961**, a first bottom buss **952** and a second bottom buss **962**. The first top buss **951** electrically connects the first top module contact **956** and the top pole **954**. The first bottom buss **952** electrically connects the first bottom module contact **957** and the bottom pole **955**. The second top buss **961** electrically connects the second top module contact **966** and the carrier **960**. The carrier **960** has a top lower throw contact **964** and a bottom upper throw contact **968**. The second bottom buss **962** electrically connects the second bottom module contact **967** and the bottom lower throw contact **965**. A center buss **963** electrically connects the top upper throw contact **967** and the bottom lower throw contact **965**.

Also shown in FIGS. **9E-F**, a slide **920** has a switch lever aperture **921**, top stops **926** and bottom stops **927**. The rocker switch lever **918** (FIG. **9C**) fits into the lever aperture **921**. The spring **925** provides resistance to movement of the slide **920** and a corresponding tactile tension to the rocker switch **910** (FIG. **9A**). When the rocker switch **910** (FIG. **9A**) is in its first position (as shown in FIG. **9A**, the lever **918** (FIG. **9C**) is in its down position (as shown in FIG. **9C**), which moves the slide **920** in its down position. When the rocker switch **910** (FIG. **9A**) is in its second position, the lever **918** (FIG. **9C**) is in its up position, which moves the slide **920** to its up position (as shown in FIGS. **9E-F**). In the slide upper position, the lower portions of the stops **926**, **927** move the poles **954**, **955** so as to connect with the upper throw contacts **967**, **968**. In the slide lower position, the upper portions of the stops **926**, **927** move the poles **954**, **955** so as to connect with the lower throw contacts **964**, **965**.

Switch Module Installation

In reference to FIG. **9B**, a switch module **900** is installed in an electrical box **600** (FIGS. **6A-B**) as described with respect to FIGS. **4D** and F, above. A switch module **900** and the wiring panel **700** (FIGS. **7A-B**) are keyed to prevent the installation of a switch module **900** into a module compartment **400** (FIG. **4D**) with an incorrect, i.e. upside-down orientation. Specifically, the module key **946** must engage the bottom panel fixture **720** (FIG. **7A**) and the ground bar **976** must engage the ground connector **718** (FIG. **7A**) for proper module orientation. The module key **946** will not engage the top panel fixture **710** (FIG. **7A**) and the ground bar **976** will not engage the bottom panel fixture **720** (FIG. **7A**) in the improper orientation. That is, the module key **946** and ground bar **976** function as keyed structures of the switch module **900**, and the ground connector **718** (FIG. **7A**) and bottom panel fixture **720** (FIG. **7A**), function as keyed structures of the wiring panel **700** (FIG. **7A**), as described with respect to the outlet module **800** (FIGS. **8A-B**), above. The keyed structures of the switch module **900** and the corresponding keyed structures of the wiring panel **700** (FIG. **7A**) insure proper orientation of the installed switch module **900**.

In reference to FIGS. **9E-F**, when a switch module **900** (FIGS. **9A-B**) is attached to a wiring panel **700** (FIGS. **7A-B**), the first top module contact **956** is electrically connected to the first top panel contact **756** (FIGS. **7E-F**), the second top module contact **966** is electrically connected to the second top panel contact **766** (FIGS. **7E-F**), the first bottom module contact **957** is electrically connected to the first bottom panel contact **757** (FIG. **7E-F**), and the second bottom module contact **967** is electrically connected to the second bottom panel contact **767** (FIGS. **7E-F**).

Also in reference to FIGS. **9E-F**, the switch module contacts **956**, **957**, **966**, **967** are spring contacts and each having a generally V-shaped contact point. During installation, as the switch module **800** (FIGS. **8A-B**) is pressed against the wiring panel **700** (FIGS. **7A-B**) the top and bottom module contacts **956**, **957**, **966**, **967** press against the corresponding top latches **714** (FIG. **7A**) and bottom latches **724** (FIG. **7A**) and eventually snap together, in a manner similar to that described with respect to the outlet module **800** (FIGS. **8A-B**), above. The snapping and unsnapping of the switch module during installation and removal creates positive tactile feedback that both a mechanical and electrical connection has been made between the switch module **900** (FIGS. **9A-B**) and the wiring panel **700** (FIGS. **7A-B**) within the module compartment **400** (FIG. **4D**).

Switch Module Configurations and Associated Wiring Panel Wiring

SPST Switch

As shown in FIGS. **9E-F**, the internal conductors **906** can be configured as a SPST (single-pole, single-throw) switch, a DPST (double-pole, single-throw) switch, a three-way switch, and a four-way switch. If the top upper throw contact **967**, the lower throw contact **964** and the bottom upper throw contact **968** are removed, the lower pole **955** and bottom lower throw contact **965** form a SPST switch. When the rocker switch **910** (FIG. **9A**) is moved to its first position, causing the slide **920** to move to its lower position, the pole **955** connects with the bottom lower throw contact **965**, electrically connecting the first bottom module contact **957** with the second bottom module contact **967**. Likewise, when

the rocker switch **910** (FIG. **9**A) is moved to its second position, causing the slide **920** to move to its upper position, the pole **955** disconnects from the bottom lower throw contact **965**, electrically disconnecting the first bottom module contact **957** with the second bottom module contact **967**. Thus, movement of the rocker switch **910** (FIG. **9**A) between its first and second positions alternately makes and breaks an electrical connection between the bottom module contacts **957**, **967**.

In reference to FIG. **7**B, the wiring panel **700** is wired for a SPST switch, as described above, by connecting the black (hot) wire of a first power cable to the first buss bottom cable connector **754** and the black wire of a second power cable to the second buss bottom cable connector **764**. In this manner, when the first bottom module contact **757** is switched to the second bottom module contact **767** via an installed SPST switch module **900** (FIGS. **9**A-B), as described with respect to FIGS. **9**E-F, above, power is switched between the first and second power cables.

DPST Switch

As shown in FIGS. **9**E-F, if the top upper throw contact **967** and the bottom upper throw contact **968** are removed, the upper pole **954** in conjunction with the top lower throw contact **964** and the lower pole **955** in conjunction with the bottom lower throw contact **965** form a DPST switch. When the rocker switch **910** (FIG. **9**A) is moved to its first position, causing the slide **920** to move to its lower position, the poles **954**, **955** connect with the corresponding lower throw contacts **964**, **965** electrically connecting the top module contacts **956**, **966** and, also, electrically connecting the bottom module contacts **957**, **967**. Likewise, when the rocker switch **910** (FIG. **9**A) is moved to its second position, causing the slide **920** to move to its upper position, the poles **954**, **955** disconnect with the corresponding lower throw contacts **964**, **965** electrically disconnecting the top module contacts **956**, **966** and, also, electrically disconnecting the bottom module contacts **957**, **967**. Thus, movement of the rocker switch **910** (FIG. **9**A) between its first and second positions alternately makes and breaks an electrical connection between the top module contacts **956**, **966** and, also, alternately makes and breaks an electrical connection between the bottom module contacts **957**, **967**.

In reference to FIG. **7**B, the wiring panel **700** is wired for a DPST switch, as described above, by removing the first **755** and second **765** buss breakaways to isolate the top panel contacts **756**, **766** (FIGS. **7**E-F) from the bottom panel contacts **757**, **767** (FIGS. **7**E-F) and, hence, isolating the top module contacts **956**, **966** (FIGS. **9**E-F) from the bottom module contacts **957**, **967** (FIGS. **9**E-F) of an installed DPST switch module. The black and white wires of a first power cable are connected to the first buss bottom **754** and top **752** cable connectors, respectively. The black and white wires of a second power cable are connected to the second buss bottom **764** and top **762** cable connectors, respectively. In this manner, when the first top panel contact **756** is switched to the second top panel contact **766** and the first bottom panel contact **757** is switched to the second bottom panel contact **767** via an installed DPST switch module **900** (FIGS. **9**A-B), as described with respect to FIGS. **9**E-F, above, an electrical load can be switched between the first and second power cables.

Three-Way Switch

As shown in FIGS. **9**E-F, if the top upper throw contact **967** is removed, the upper pole **954** in conjunction with the top lower throw contact **964** and the lower pole **955** in conjunction with the bottom lower and upper throw contacts **965**, **968** form a three-way switch. When the rocker switch **910** (FIG. **9**A) is moved to its first position, causing the slide **920** to move to its lower position, the poles **954**, **955** connect with the corresponding lower throw contacts **964**, **965** electrically connecting the top module contacts **956**, **966** and, also, electrically connecting the bottom module contacts **957**, **967**. When the rocker switch **910** (FIG. **9**A) is moved to its second position, causing the slide **920** to move to its upper position, the top pole **954** is disconnected. The bottom pole **955**, however, is connected with the bottom upper throw contact **968**, which is connected to the second top module contact **966** via the carrier **960** and the second top buss **961**. Thus, movement of the rocker switch **910** (FIG. **9**A) between its first and second positions alternately makes and breaks an electrical connection between the bottom module contacts **957**, **967** and, also, electrically connects the second top module contact **966**, alternately, with the first top module contact **956** and the first bottom module contact **957**.

Four-Way Switch

As shown in FIGS. **9**E-F, if all of the conductors **906** are in place, the upper pole **954** in conjunction with the top lower and upper throw contacts **964**, **967** and the lower pole **955** in conjunction with the bottom lower and upper throw contacts **965**, **968** form a four-way switch. When the rocker switch **910** (FIG. **9**A) is moved to its first position, causing the slide **920** to move to its lower position, the poles **954**, **955** connect with the corresponding lower throw contacts **964**, **965** electrically connecting the top module contacts **956**, **966** and, also, electrically connecting the bottom module contacts **957**, **967**. When the rocker switch **910** (FIG. **9**A) is moved to its second position, causing the slide **920** to move to its upper position, the poles **954**, **955** connect with the corresponding upper throw contacts **967**, **968**, electrically connecting the top first module contact **956** with the bottom second module contact **967** via the center buss **963** and, also, electrically connecting the bottom first module contact **957** with the top second module contact **966** via the carrier **960** and the second top buss **961**. Thus, movement of the rocker switch **910** (FIG. **9**A) between its first and second positions makes an electrical connection between the bottom module contacts **957**, **967** and, also, between the top module contacts **956**, **966**, and, alternately, makes an electrical connection between the first top module contact **956** and the second bottom module contact **967** and, also, between the first bottom module contact **957** and the second top module contact **966**.

The outlet module **800** (FIGS. **8**A-B) and switch module **900** (FIGS. **9**A-B) are described above as having top and bottom contacts at the back side of the back covers **804** (FIG. **8**B), **904** (FIG. **9**B), with corresponding contact placement on the wiring panel front side **702** (FIGS. **7**A-B). Other contact placements can be used with the system. For example, one of ordinary skill in the art will recognize that side contacts along the back side of the back covers or contacts along the edges or sides of the module covers also would be feasible. Further, the modules **800** (FIGS. **8**A-B), **900** (FIGS. **9**A-B) are described above as having spring contacts, with corresponding latches and contact surfaces located on the wiring panel **700** (FIGS. **7**A-B). Other contact types and combinations can be used with the system. For example, contact surfaces and latches mounted in the modules **800** (FIGS. **8**A-B), **900** (FIGS. **9**A-B), with corresponding spring contacts mounted in the wiring panel **700** (FIGS. **7**A-B) are also feasible.

Face Plates

FIGS. **10A-D** illustrate a face plate **1000**, which provides the wall trim for an installed electrical outlet **310** or switch **360**, as described with respect to FIG. **2**, above. As shown in FIGS. **10A-B**, one embodiment of a face plate **1000** has a flared-rectangular-shaped cover plate **1010** and a cover aperture **1020**. In another embodiment, the face plate **1000** has a rectangular-shaped cover plate **1080** (FIG. **10C**). In yet another embodiment, the face plate **1000** has an oval-shaped cover plate **1090** (FIG. **10D**). The cover plate **1010** has a front side **1012**, which is the visible trim when installed, and a back side **1014**, which is not visible when installed flush against a wall. The cover aperture **1020** has straight edges and semi-circular ends and fits over the similarly shaped raised portion **810** (FIG. **8A**) of an outlet module **800** (FIGS. **8A-B**) or the similarly shaped rocker switch **910** (FIG. **9A**) of a switch module **900** (FIGS. **9A-B**).

As shown in FIG. **10B**, the face plate **1000** is installed onto and removed from an installed module **800** (FIGS. **8A-B**), **900** (FIGS. **9A-B**) without the use of separate fasteners, such as conventional screws. The plate back side **1014** has protruding tabs **1030**, each with an indented portion **1032** that latch onto an outlet module catch **803** (FIG. **8D**) or switch module catch **903** (FIG. **9C**). The tabs **1030** releasably retain the face plate **1000** when pressed onto an installed outlet module **800** (FIGS. **8A-B**) or switch module **900** (FIGS. **9A-B**). In this manner, the face plate **1000** covers the wall-mounted electrical box **600** (FIGS. **6A-B**) and the modules installed therein.

Protective Cover

FIGS. **11A-B** illustrate a protective cover **1100**, which protects the interior of the electrical box **600** (FIGS. **6A-B**), the wiring panel **700** (FIGS. **7A-B**), and the associated power cables installed within the electrical box **600** (FIGS. **6A-B**) during the makeup phase, as described with respect to FIG. **14B**, below. The protective cover **1100** has a shield plate **1110**, a top sleeve **1120** and a bottom sleeve **1130**. The shield plate **1110** is generally planar and dimensioned to closely conform to the interior of the electrical box **600** (FIG. **6A**) and the wiring panel front side **702** (FIG. **7A**). The top sleeve **1120** extends perpendicularly from the shield plate **1110** so that the top sleeve inside **1122** fits over the top panel fixture **710**. The bottom sleeve **1130** also extends perpendicularly from the shield plate **1110** so that the bottom sleeve inside **1132** fits over the bottom panel fixture **720**. The shield plate has post slots **1140**, cutouts **1150**, mounting holes **1160**, and a plug opening **1170**. The post slots **1140** allow the protective cover **1100** to slide over the module mounting posts **622** (FIG. **6B**) during installation in the electrical box **600** (FIGS. **6A-B**). The cutouts **1150** and the mounting holes **1160** work in conjunction to allow the protective cover **1100** to be easily secured to and removed from the wiring panel **700** (FIGS. **7A-B**) without unfastening the wiring panel **700** (FIGS. **7A-B**) from the electrical box **600** (FIGS. **6A-B**), as described with respect to FIG. **12**, below. The plug opening **1170** allows a standard AC plug to access the wiring panel socket **730** when the protective cover is in place, as described with respect to FIG. **14B**, below.

Protective Cover Installation

FIG. **12** illustrates a protective cover **1100** during installation over a wiring panel **700**. The protective cover **1100** is installed in the interior of the electrical box **600** (FIGS. **6A-B**) and positioned so as to shield the exposed front side **702** of the wiring panel **700**, as described with respect to FIG. **14B**, below. The fasteners **707** corresponding to the mounting holes **1160** are removed from the wiring panel **700**. The fasteners **707** corresponding to the cutouts **1150** are not removed during installation or removal of the protective cover **1100**, allowing the wiring panel **700** to remain secured inside the electrical box (not shown). As shown in FIG. **12**, the protective cover **1100** is positioned within the electrical box (not shown) adjacent the wiring panel **700** so that the protective cover front side **1112** is away from the wiring panel front side **730** and the protective cover plug opening **1170** aligns with the wiring panel socket **730**. In this position, the protective cover **1100** is simply pressed against the wiring panel **700** so that the top panel fixture **710** fits within the top sleeve **1120**, the bottom panel fixture **720** fits within the bottom sleeve **1130** and the cutouts **1150** fit around the remaining fasteners **707**. The protective sleeve **1100** then may be secured to the wiring panel **700** with the removed fasteners **707** threaded through the protective cover mounting holes **1160**, the wiring panel mounting holes **708** (FIG. **7C**) and the electrical box panel mounting posts **620** (FIGS. **6A-B**). Removal of the protective cover **1100** from the wiring panel **700** prior to module installation simply proceeds in the reverse of the above-described steps. The top sleeve **1120** and bottom sleeve **1130** provide a gripping surface for removing the protective sleeve **1100**.

Box Mount and Electrical Box Installation

FIGS. **13A-C** illustrate an electrical box **600** mounted on a box mount **500**. The electrical box **600** is typically mounted after the box mount **500** is installed on a wall stud, as described with respect to FIG. **14A**, below. FIG. **13A** illustrates the installation of the electrical box **600** on the box mount **700** and illustrates the releasable latch **650** within the electrical box **600** used to lock the electrical box **600** in a fixed position relative to the box mount **500** and, correspondingly, release the electrical box **600** so that it can be moved to another fixed position. FIGS. **13B-C** illustrate the various fixed positions of the electrical box **600**.

As shown in FIG. **13A**, the electrical box **600** is mounted so that the slides **630** are movably retained within the mounting brackets **530** and the guides **640** are moveable within box mount grooves **540** (FIGS. **6A-B**). The releasable latch **650** has a tab portion **654** (FIGS. **6A-B**) that fits within box mount catch slots **560** (FIGS. **13B-C**) to lock the electrical box **600** at various fixed positions. The latch **650** is released and the electrical box **600** moved to different positions by inserting a screwdriver tip or similar tool into a latch release portion **1310**. The screwdriver is then twisted so that the screwdriver tip pushes the release portion **1310** away from the electrical box wall, temporarily lifting the tab portion **654** from a catch slot **560** (FIGS. **13B-C**). With the latch **650** released, the electrical box **600** can be repositioned along the box mount **500** or removed from the box mount **500** utilizing the finger grip **670** to pull or push the electrical box **600** along the mounting brackets **530**.

As shown in FIGS. **13B-C**, the electrical box **600** can be releasably locked in any one of several fixed positions. Each of these fixed positions locates the front face **602** a specific distance from the box mount leading edge **502**. The box mount **500** is installed on a wall stud, and the leading edge **502** functions as an alignment guide along an edge of the wall stud, as described with respect to FIG. **14A**, below. The tab portion **654** of the electrical box latch **650** (FIG. **13A**), releasably engages any one of several catch slots **560**, which are located at measured positions along the box mount **500**. In this manner, the electrical box **600** is positioned so that its open front face **602** is flush with an installed wall panel, advantageously accommodating various wall panel thick-

nesses. Position indicators **660** align with the leading edge **502** to visibly indicate the distance from the leading edge **502** to the open face **602** associated with the various catch slots **560** and, hence, the various fixed positions of the electrical box **600**.

As shown in FIG. **13**B, the electrical box **600** is locked in a first position. A particular catch slot **1324** retains the latch tab portion **654**, and a corresponding position indicator **1322** aligns with the leading edge **502**, visibly indicating 1.25 inches. Thus, the electrical box front face **602** extends from the box mount leading edge **502** and, hence, a wall stud edge, by 1.25 inches.

As shown in FIG. **13**C, the electrical box **600** is locked in a second position. A particular catch slot **1334** retains the latch tab portion **654**, and a corresponding position indicator **1332** aligns with the leading edge **502**, visibly indicating 1.75 inches. Thus, the electrical box front face **602** extends from the box mount leading edge **502** and, hence, a wall stud, by 1.75 inches. In a particular embodiment, the electrical box front face **602** can be extended from the box mount leading edge **502**, and hence a wall stud edge, at specific distances in the range of between 0.5 inches and 1.75 inches. In another particular embodiment, the electrical box front face **602** can be extended from the box mount leading edge **502**, and hence a wall stud edge, at specific distances of 0.5, 0.625, 1.25 and 1.75 inches.

The electrical box **600** is described above as having a latch with a tab portion that engages catch slots located along the box mount **500**. Other mechanisms for locking the electrical box **600** at various fixed positions relative to the box mount **500** can also be used. For example, the electrical box **600** could have various catch slots, with a latch located on the box mount **500**. The catch slots could be any shaped aperture, which is engaged with a correspondingly shaped tab portion of the latch.

The box mount **500** is described above as having a leading edge that functions as an alignment guide. Other features of the box mount could also function as an alignment guide. For example, a feature, such as an arrow or similar indicator could be molded or otherwise attached to the box mount and used as an alignment guide.

Installation at Rough Framing Phase

FIGS. **14**A-B illustrate a mounted electrical box and associated components installed on a wall stud. FIG. **14**A illustrates a partial electrical box assembly **1400** including a box mount **500** attached to a wall stud **1402**, a mounted electrical box **600** and an installed wiring panel **700**. FIG. **14**B illustrates a shielded partial electrical box assembly **1460** including a protective cover **1100** installed over the wiring panel **700** (FIG. **14**A) of the partial electrical box assembly **1400** (FIG. **14**A).

As shown in FIG. **14**A, the box mount **500** is attached to a wall stud **1402** by aligning the box mount leading edge **502** as a guide along the stud's wall-facing edge **1404** and hammering in the fasteners **522**, which can be staples, nails or similar devices. The electrical box **600** is then attached to the box mount **500**, as described with respect to FIG. **13**A, above. This alignment in conjunction with the box mount fixed positions **560** (FIGS. **13**B-C) provides a specific distance from the wall stud to the electrical box opening **602**, allowing the electrical box to be installed flush with a wall panel finished exterior surface, i.e. the surface typically painted during the makeup phase, as described with respect to FIGS. **13**B-C, above.

Also shown in FIG. **14**A is an installed wiring panel **700**. The wiring panel **700** is installed within the electrical box **600** by positioning the wiring panel **700** at the box open front **602** so that the mounting post slots **706** fit over the mounting posts **620**. The wiring panel **700** is then inserted into the electrical box **600** until the wiring panel back side **704** (FIG. **7**B) abuts the panel mounting posts **610** (FIGS. **6**A-B). The wiring panel **700** is secured within the electrical box **600** against the panel mounting posts **610** (FIGS. **6**A-B) by inserting fasteners **707**, which are screws or equivalent devices, through the mounting holes **708** (FIGS. **7**A-B) and into the panel mounting post centered holes **612** (FIGS. **6**A-B). The grips **709** are used to manually grasp and position the wiring panel **700** during installation. One grip **709** also allows access to the electrical box latch **650** (FIG. **13**A), for positioning the electrical box after installation of the wiring panel **700**.

FIG. **14**A shows the partial electrical box assembly **1400** as it would appear in the rough phase or during replacement of a defective module. The wiring panel **700** partitions the electrical box interior into a user accessible module compartment **400** between the front face **602** and the wiring panel front side **702** and a user inaccessible wiring compartment (not visible) between the back face **604** (FIG. **6**B) and the wiring panel back side **704** (FIG. **7**B). The term user accessibility as used herein is understood to mean access without removal of the wiring panel **700**. The module compartment **400** is dimensioned for installation of an outlet module **800** (FIGS. **8**A-B), switch module **900** (FIGS. **9**A-B) or similar module, such as a dimmer switch. The wiring compartment contains cable connectors for installation of power cables by a journeyman electrician.

As shown in FIG. **14**A, the partitioning of the electrical box interior advantageously allows access only to the module compartment **400**, which is physically separated from the exposed wiring of the power cables within the wiring compartment (not visible). There is no access to the building electrical wiring without physical removal of the wiring panel **700**, preserving the integrity of the electrical wiring from third-party tampering and protecting third-parties from the shock hazard of exposed high voltage conductors. Further, there are no external parts to interfere with wall panel installation, and there are no exposed cables within the module compartment **400** susceptible to fouling or damage during the makeup building phase. Access to the module compartment, however, which has shielded, snap-in contacts, as described with respect to FIG. **7**B, above, allows easy and comparatively safe installation or replacement of modules by unskilled personnel.

Prior to module installation, which would typically occur after the makeup phase is complete, a socket **730** is available for accepting a standard AC plug, providing electrical power at the construction site after verification that the wiring panel **700** is properly wired. Punch-outs or other panel markings (not shown) indicate how the panel **700** is wired, such as full hot, half hot, SPST switch, DPST switch, 3-way switch, 4-way switch as described with respect to FIGS. **15-16**, below.

As shown in FIG. **14**B, the protective cover **1100** shields the interior of the electrical box **600** and, in particular, the exposed front side of the wiring panel **700** (FIG. **14**A). In this manner, the electrical box **600** and wiring panel **700** (FIG. **14**A) are advantageously protected from drywall compound, paints and other materials used during wall panel installation. Prior art wiring assemblies, during this makeup phase, have exposed power cables simply coiled up and pushed into bare electrical boxes, exposing the wires to fouling and damage from routers used during wall panel installation, as described above. On the other hand, nothing

is exposed to fouling or damage in the partial wiring assembly **1460**. After the makeup phase is complete, the shield **1100** can be easily removed, as described with respect to FIG. **12**, above. The protective cover **1100** has a plug opening **1170** (FIG. **11**) corresponding to the wiring panel socket **730** (FIG. **14A**), allowing a standard AC plug **1490** to be inserted through the protective cover **1100** and into the socket **730** (FIG. **14A**) for access to electrical power without removal of the protective cover **1100**, e.g. during the makeup phase.

Adapter Wiring Panel

FIG. **15** illustrates an adapter wiring panel **1500**, which has a wiring panel **700** (FIGS. **7A-B**) modified with adapter brackets **1510**. The adapter brackets **1510** each have a post **1520**, an end piece **1530** and a clip **1540**. The post **1520** is fixedly attached to the board **701**, extending perpendicularly away from the front face **702**. The end piece **1530** is attached to the end of the post **1520** distal the board **701**. The clip **1540** is attached to the end piece **1530** perpendicularly to the post **1520**. Mounting holes **1532** are provided in each end piece **1530**. The adapter wiring panel **1500** is installed within a standard electrical box **100** (FIG. **1**) with the clips **1540** attached along the top and bottom box edges and secured with screws **130** (FIG. **1**) or equivalent fasteners inserted through the mounting holes **1532** and into the mounting posts at the top and bottom of the electrical box **100** (FIG. **1**). In this manner, a standard electrical box **100** (FIG. **1**) can be converted to a safety electrical outlet and switch system that accepts snap-in outlet and switch modules. Conveniently, the adapter board can be installed in lieu of a wiring panel **700** (FIGS. **7A-B**) in the electrical box **600** (FIGS. **6A-B**) utilizing the clips **1540** rather than securing a wiring panel **700** (FIGS. **7A-B**) with fasteners **707** (FIG. **7C**).

A safety electrical outlet and switch system has been disclosed in detail in connection with various embodiments. These embodiments are disclosed by way of examples only and are not to limit the scope of the claims that follow. One of ordinary skill in the art will appreciate many variations and modifications.

What is claimed is:

1. An electrical wiring method comprising the steps of:

mounting an electrical box having an open front face on a wall stud;

installing a wiring panel within said electrical box so as to partition the interior of said electrical box into a user inaccessible wiring compartment proximate a back side of said wiring panel and a user accessible module compartment proximate a front side of said wiring panel, said back side of said wiring panel having one or more electrical connections with one or more electrical wires and

attaching a protective cover to said wiring panel so as to protect said wiring panel during wall panel installation and painting, said protective cover preventing access to said electrical wires connecting to said back side of said wiring panel,

wherein said user accessible module compartment is adapted to accept a module having a user operable electrical function, and

wherein said module is mountable to said front side of said wiring panel.

2. An electrical wiring method comprising the steps of:

mounting an electrical box having an open front face on a wall stud;

installing a wiring panel within said electrical box so as to partition the interior of said electrical box into a user inaccessible wiring compartment proximate a back side of said wiring panel and a user accessible module compartment proximate a front side of said wiring panel;

attaching a protective cover to said wiring panel so as to protect said wiring panel during wall panel installation and painting,

removing said protective cover from said wiring panel after wall panel installation; and

inserting said module into said module compartment,

wherein said user accessible module compartment is adapted to accept a module having a user operable electrical function, and

wherein said module is mountable to said front side of said wiring panel.

3. The electrical wiring method according to claim **2** wherein said attaching step comprises the substep of fitting a portion of said protective cover extending generally perpendicularly from said protective cover over a portion of said wiring panel extending from said front side of said wiring panel.

4. The electrical wiring method according to claim **3** wherein said attaching step comprises the further substep of at least substantially covering said front side of said wiring panel with said protective cover.

5. The electrical wiring method according to claim **4** wherein said attaching step comprises the further substep of at least substantially shielding said open front face of said electrical box with said protective cover.

* * * * *

JS 44 (Rev. 12/07)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE REVERSE OF THE FORM.)

I. (a) PLAINTIFFS
ProtectConnect, Inc.

DEFENDANTS
Leviton Manufacturing Co., Inc., et al.

FILED
10 APR 12 PM 3:11
CLERK U.S. DISTRICT COURT
SOUTHERN DISTRICT OF CALIFORNIA
BY: DEPUTY

(b) County of Residence of First Listed Plaintiff San Diego
(EXCEPT IN U.S. PLAINTIFF CASES)

County of Residence of First Listed Defendant Suffolk County, New York
(IN U.S. PLAINTIFF CASES ONLY)
NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE LAND INVOLVED.

(c) Attorney's (Firm Name, Address, and Telephone Number)
Jesse Hindman (Bar No.222935)
DLA PIPER LLP (US)
401 B Street, Suite 1700
San Diego, CA 92101-4297
(619) 699-2700

Attorneys (If Known) MTP

'10CV0758 MMA RBB

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
- ☒ 3 Federal Question (U.S. Government Not a Party)
- ☐ 2 U.S. Government Defendant
- ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)
(For Diversity Cases Only)

	PTF	DEF		PTF	DEF
Citizen of This State	☐ 1	☐ 1	Incorporated *or* Principal Place of Business In This State	☐ 4	☐ 4
Citizen of Another State	☐ 2	☐ 2	Incorporated *and* Principal Place of Business In Another State	☐ 5	☐ 5
Citizen or Subject of a Foreign Country	☐ 3	☐ 3	Foreign Nation	☐ 6	☐ 6

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT
- ☐ 110 Insurance
- ☐ 120 Marine
- ☐ 130 Miller Act
- ☐ 140 Negotiable Instrument
- ☐ 150 Recovery of Overpayment & Enforcement of Judgment
- ☐ 151 Medicare Act
- ☐ 152 Recovery of Defaulted Student Loans (Excl. Veterans)
- ☐ 153 Recovery of Overpayment of Veteran's Benefits
- ☐ 160 Stockholders' Suits
- ☐ 190 Other Contract
- ☐ 195 Contract Product Liability
- ☐ 196 Franchise

REAL PROPERTY
- ☐ 210 Land Condemnation
- ☐ 220 Foreclosure
- ☐ 230 Rent Lease & Ejectment
- ☐ 240 Torts to Land
- ☐ 245 Tort Product Liability
- ☐ 290 All Other Real Property

TORTS

PERSONAL INJURY
- ☐ 310 Airplane
- ☐ 315 Airplane Product Liability
- ☐ 320 Assault, Libel & Slander
- ☐ 330 Federal Employers' Liability
- ☐ 340 Marine
- ☐ 345 Marine Product Liability
- ☐ 350 Motor Vehicle
- ☐ 355 Motor Vehicle Product Liability
- ☐ 360 Other Personal Injury

PERSONAL INJURY
- ☐ 362 Personal Injury—Med. Malpractice
- ☐ 365 Personal Injury — Product Liability
- ☐ 368 Asbestos Personal Injury Product Liability

PERSONAL PROPERTY
- ☐ 370 Other Fraud
- ☐ 371 Truth in Lending
- ☐ 380 Other Personal Property Damage
- ☐ 385 Property Damage Product Liability

CIVIL RIGHTS
- ☐ 441 Voting
- ☐ 442 Employment
- ☐ 443 Housing/ Accommodations
- ☐ 444 Welfare
- ☐ 445 Amer. w/Disabilities - Employment
- ☐ 446 Amer. w/Disabilities - Other
- ☐ 440 Other Civil Rights

PRISONER PETITIONS
- ☐ 510 Motions to Vacate Sentence

Habeas Corpus:
- ☐ 530 General
- ☐ 535 Death Penalty
- ☐ 540 Mandamus & Other
- ☐ 550 Civil Rights
- ☐ 555 Prison Condition

FORFEITURE/PENALTY
- ☐ 610 Agriculture
- ☐ 620 Other Food & Drug
- ☐ 625 Drug Related Seizure of Property 21 USC 881
- ☐ 630 Liquor Laws
- ☐ 640 R.R. & Truck
- ☐ 650 Airline Regs.
- ☐ 660 Occupational Safety/Health
- ☐ 690 Other

LABOR
- ☐ 710 Fair Labor Standards Act
- ☐ 720 Labor/Mgmt. Relations
- ☐ 730 Labor/Mgmt.Reporting & Disclosure Act
- ☐ 740 Railway Labor Act
- ☐ 790 Other Labor Litigation
- ☐ 791 Empl. Ret. Inc. Security Act

IMMIGRATION
- ☐ 462 Naturalization Application
- ☐ 463 Habeas Corpus – Alien Detainee
- ☐ 465 Other Immigration Actions

BANKRUPTCY
- ☐ 422 Appeal 28 USC 158
- ☐ 423 Withdrawal 28 USC 157

PROPERTY RIGHTS
- ☐ 820 Copyrights
- ☒ 830 Patent
- ☐ 840 Trademark

SOCIAL SECURITY
- ☐ 861 HIA (1395ff)
- ☐ 862 Black Lung (923)
- ☐ 863 DIWC/DIWW (405(g))
- ☐ 864 SSID Title XVI
- ☐ 865 RSI (405(g))

FEDERAL TAX SUITS
- ☐ 870 Taxes (U.S. Plaintiff or Defendant)
- ☐ 871 IRS—Third Party 26 USC 7609

OTHER STATUTES
- ☐ 400 State Reapportionment
- ☐ 410 Antitrust
- ☐ 430 Banks and Banking
- ☐ 450 Commerce
- ☐ 460 Deportation
- ☐ 470 Racketeer Influenced and Corrupt Organizations
- ☐ 480 Consumer Credit
- ☐ 490 Cable/Sat TV
- ☐ 810 Selective Service
- ☐ 850 Securities/Commodities/ Exchange
- ☐ 875 Customer Challenge 12 USC 3410
- ☐ 890 Other Statutory Actions
- ☐ 891 Agricultural Acts
- ☐ 892 Economic Stabilization Act
- ☐ 893 Environmental Matters
- ☐ 894 Energy Allocation Act
- ☐ 895 Freedom of Information Act
- ☐ 900Appeal of Fee Determination Under Equal Access to Justice
- ☐ 950 Constitutionality of State Statutes

V. ORIGIN (Place an "X" in One Box Only)
☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from another district (specify) ☐ 6 Multidistrict Litigation ☐ 7 Appeal to District Judge from Magistrate Judgment

VI. CAUSE OF ACTION
Cite the U.S. Civil Statute under which you are filing **(Do not cite jurisdictional statutes unless diversity):**
35 U.S.C. Section 1 et seq.
Brief description of cause:
Patent infringement

VII. REQUESTED IN COMPLAINT: ☐ CHECK IF THIS IS A **CLASS ACTION** UNDER F.R.C.P. 23 **DEMAND $**
CHECK YES only if demanded in complaint: **JURY DEMAND:** ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY (See instructions): JUDGE _____ DOCKET NUMBER _____

DATE
April 12, 2010

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